

Simplified

PEDIATRICS

(Part One)

By

*The Board of pediatrics Department
Zagazig University*



Arranged by

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MRCPCH-MD

Dr. Mohamed A. Arafa

MD Pediatrics

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ قَالُوا سُبْحَنَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا ۚ

إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ ﴾ (٣٢)

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

“سورة البقرة الآية ٣٢”

GENERAL PEDIATRICS

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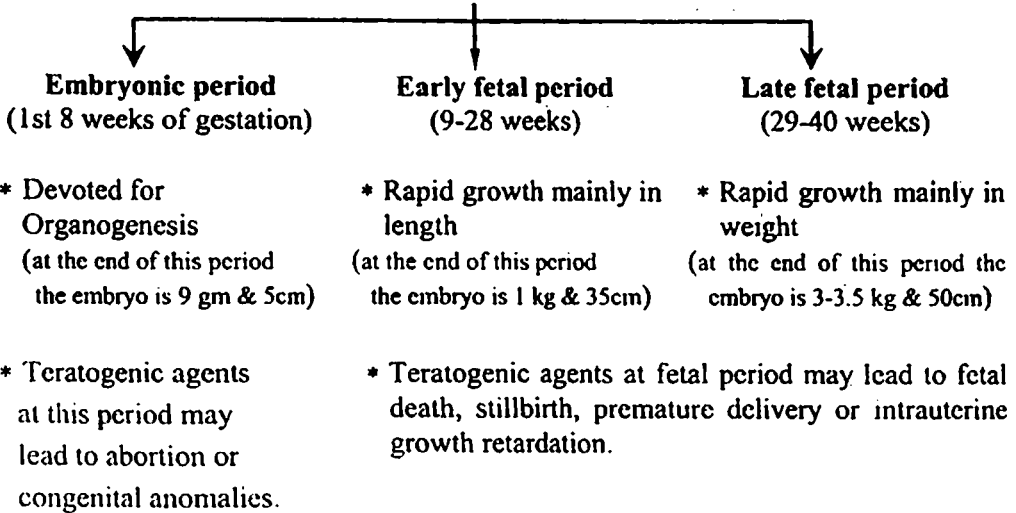
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CHAPTER (I)

GROWTH AND DEVELOPMENT

Growth = Increase the size of the organism due to increase size and/or number of its constituent cells.

Development = Maturation of functions, acquisition of skills and adaptation to stress.

STAGES OF GROWTH AND DEVELOPMENT**1) Intrauterine Stage****2) Extrauterine Stage**

Stage	Age	Characteristics
Infant	Birth to 1 year	Period of rapid growth and change; attachments to family members and other caregivers are formed; trust develops.
Toddler	1 to 3 years	Motor ability, coordination, sensory skills developing; basic feelings, emotions, a sense of self, and being independent become important.
Preschooler	3 to 6 years	Continued physiological, psychological, and cognitive growth; better able to care for selves, interested in playing with other children; beginning to develop a concept of who they are.
School age	6 to 12 years	Interested in achievement; ability to read, write, and complete academic work advances; understanding of the world broadens.
Adolescent	12 to 19 years, or later	Transition period between childhood and adulthood; physiological maturation occurs. formal operational thought begins; preparation for becoming an adult takes place

FACTORS AFFECTING GROWTH AND DEVELOPMENT

I) Factors operating before conception:

- **Racial factors:** e.g. Scandinavian are taller than yellow races.
- **Familial factors:** e.g. Some families tend to be tall.

II) Factors operating during pregnancy:

- **Maternal diseases** either infectious (rubella, toxoplasma,) or non infectious (DM, hypertension,).
- **Maternal exposure to hypoxia** e.g. anaesthesia
- **Maternal drug intake** during pregnancy.
- **Maternal irradiation** during pregnancy.
- **Maternal malnutrition** during pregnancy.

III) Factors operating after delivery:

- **Age:** Rate of growth is not equal e.g. growth is more during infancy than early childhood.
- **Sex:**
 - * Up to 11 years nearly equal (slight faster in male).
 - * 11-14 years female > male
 - * After 14 yrs male > female.
- **Hormones:**
 - * **Fetal life:** growth is under the effect of chorionic gonadotropins and placental growth factors.
 - * **During infancy:** growth is under the effect of growth hormone and thyroxine.
 - * **In adolescence:** sex hormones enhance growth.
- **Nutritional status**
- **Psychological status**
- **Others:** chronic illness & socioeconomic factors.

PATTERNS OF GROWTH

- **General** → Growth of Bones, Muscles and Soft tissues.
- **Genital** → Growth of Genital organs.
- **Nervous** → Growth of CNS.
- **Lymphatic** → Growth of Lymphatic system.

ASSESSMENT OF GROWTH AND DEVELOPMENT

1- Anthropometric Measures

Weight:

- At birth $\rightarrow 3 - 3.5$ Kg
- 0 - 4 months $\rightarrow \uparrow$ by $\frac{3}{4}$ Kg/month (so at 4 months = 6 kg).
- 5 - 8 months $\rightarrow \uparrow$ by $\frac{1}{2}$ kg/ month (so at 8 months = 8 kg)
- 9 - 12 months $\rightarrow \uparrow$ by $\frac{1}{4}$ kg/month (so at 1 year = 9 kg).
- Beyond the 1st year $\text{Wt.} = \text{Age (yrs)} \times 2 + 8$
(The infant doubles his wt. at 4 months)

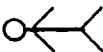
☞ N.B.

During the 1st 3-4 days of life initial weight loss (up to 10%) occurs due to urine and meconium loss while maternal milk flow is scanty. This loss is usually regained by the 10th day of life.

Length:

- At birth $\rightarrow 50$ cm
- At 3 months $\rightarrow 59$ cm
- At 6 months $\rightarrow 68$ cm
- At 1 year $\rightarrow 75$ cm
- After that $\text{Length} = \text{Age (yrs)} \times 5 + 80$
(The infant doubles his length at 4 years)

☞ N.B.:

- 1- Length  & height 

Length is 0.5 cm more than height due to joint compression during standing.

- 2- Interrelation of weight and length:

- $\downarrow\downarrow$ wt. & normal length $\approx$ recent nutritional deficiency.
- Normal wt. & $\downarrow\downarrow$ length $\approx$ old nutritional deficiency.
- $\downarrow\downarrow$ wt. & $\downarrow\downarrow$ length $\approx$ both old and recent nutritional deficiency.

Head and chest circumference:

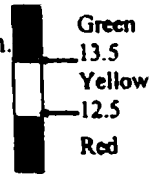
Age	Head	Chest	Comment
• Birth	35	33	Head > Chest
• 6 months	43	43	Equal
• 1 year	45	47	Chest > Head
• 2 years	48	50	Chest > Head
• 6 years	50	55	Chest > Head
• 12 years	55	60 or more	Chest > Head

☞ N.B.

- Head circumference is very important parameter for brain development, so its maximum rate of growth is during the first year of life (≈ 10 cm).
- persistence of infantile proportions should suggest malnutrition or hydrocephalus

Mid arm circumference (MAC):

- It's the best & earliest indicator of malnutrition and not affected by oedema.
- It is measured midway between acromion and olecranon.
- Normally MAC is > 13.5 cm in children 1- 4 years old.
- If 12.5-13.5 = moderate malnutrition & if < 12.5 = severe malnutrition.
- Can be measured by Shakir strips



Proportion of upper and lower body segments:

- Upper segment = crown to symphysis pubis.
- Lower segment = symphysis pubis to heel.
- * At birth US/LS = 1.7 * At 3 yrs US/LS = 1.3 * After 7 yrs US/LS = 1
- Persistent fetal or infantile proportions may indicate linear growth disturbances e.g. achondroplasia or hypothyroidism.

Span / height ratio:

- Normally the span is less than the height by about 3 cm in children below 8 years and equal in children between 8-12 years.

Skin fold thickness:

- Skin fold thickness over the triceps measured by skin fold calipers can roughly estimate subcutaneous fat.

2- Fontanelles

- * **6 Fontanelles** are present (1 posterior, 1 anterior, 2 mastoid & 2 sphenoid).

- * **Posterior fontanelle:**
 - Normally closed at birth or 1-2 months.
 - If > 0.5 cm at birth it may indicate prematurity, mongolism, cretinism or increase ICT.

- * **Value of Anterior fontanelle examination:**

- 1- **Size** → normally
 - 3 fingers at birth.
 - 2 fingers at 6 months.
 - 1 finger at 12 months.
 - closed at 18 months.

It can be also measured in centimeters = $\frac{\text{anteroposterior diameter} + \text{transverse diameter}}{2}$

- a- If absent at birth it may indicate:
 - Excess moulding.
 - overlying caput succedaneum

- b- Premature closure = microcephaly, craniosynostosis

- c- Delayed closure = cretinism, mongolism, rickets, osteogenesis imperfect & achondroplasia .

- d- Widely open = local brain causes (↑ ICT) as in hydrocephalus.

- 2- **Pulsating normally** with heart beats:

(If tense non pulsating = Marked ↑↑ ICT)

- 3- **Surface** (Normally smooth, and continuous with adjacent skull bones).

- * Bulging → ↑ ICT (hydrocephalus, encephalitis, meningitis and IC hge).

- * Depressed → ↓ extracellular fluid (Shock & dehydration.)

N.B.: Anterior fontanel may be used as a window for cranial ultrasound.

3- Teething

1 ry (Milk teeth)		
6-9 months		central incisor
9-12 months		lateral incisor
18 months		Canine
12-15 months		1 st Molar
24 months		2 nd Molar

2 ry (Permanent teeth)		
7 yrs		central incisor
8 yrs		lateral incisor
10 yrs		canine
11 yrs		1 st premolar
12 yrs		2 nd premolar
6 yrs		1 st molar
13 yrs		2 nd molar
22 yrs		wisdom teeth

Causes of delayed teething

(considered significant if no teething occurs after the first birthday)

- Same causes of delayed A.F. closure but local causes (cyst, supernumerary teeth) instead of ↑ ICT

Premature loss of teeth:

Histiocytosis x, cyclic neutropenia & vitamin D resistant rickets.

Abnormal teeth colours

Red in porphyria

Dark grey with oral iron therapy

Yellow with tetracycline therapy

Premature teeth eruption

- Natal teeth.
- Congenital Syphilis (Hutchinson's teeth).
- Ellis Van Creveland Syndrome (small chest, polydactyly, short stature & ASD)

Anodontia

May occur in ectodermal dysplasia & Marfan syndrome.

4- Motor Development

I) During Infancy

(Gross motor skills)

- *Birth → Turn head from side to side.
- *3m. → Head support
- *4m. → Push with feet when held erect
- *5m. → Sits with full trunkal support
- *6m. → Sits with pelvic support.
- *7m. → Sits alone
- *8m. → Rolls over
- *9m. → Crawling
- *10m. → Standing
- *12m. → Walks (Holding furniture)
- *15m. → Walks alone.

II) During childhood

(More refined skills)

- ** 1.5 yr - go up stairs in child manner
+ runs stiffly
- ** 2 yrs - go down stairs in child manner
+ runs freely
- ** 3 yrs. - go up stairs in adult manner
- ** 4 yrs. - go down stairs in adult manner
- ** 5 yrs. - hop on one feet

III) During late childhood

(Fine motor skills)

- 6 years old child can:
- Write.
 - Dress himself.

5- Mental Development

I During infancy

(Social development)

- *2m. → social smile
- *3m. → listens to music
- *4m. → laughs

II During childhood

(Speech development)

- *1 y → says 2-3 words
- *1.5y → says 10 words
- *2 y → says 3 word sentence (telegraphic sentence)
- *3 y → gives full name, age + draw a circle.
- *4 y → tell story + draw a square.
- *5 y → clear speech & ask for meaning of words + draw a triangle.

III During late childhood

(school achievement)

- *6 years old child can draw a man with all features (draw a man test)

N.B.: When to consider delayed walking?

After the age of 18 months in girls and 22 months in boys.

N.B.: Developmental assessment depends on many aspects that can be tested using developmental scales e.g. Denver developmental score.

N.B.: Hand preference is usually fixed by the time a child is 5 years old. Handedness before 1 year may be indicative of a problem with the non-preferred-side (e.g., hemiparesis, brachial plexus injury).

6- Osseous Maturation

* Ossification of the fetal bones begins at the 5th month intrauterine (Clavicle, skull,..)

* Long bones ossification occurs as follows:

I- Intrauterine ossific centers:

* Calcaneous (5 m.), Talus (7m.), Cuboid (8m.).

* Proximal tibia (9m.), Lower femur (9m.).

II- Extrauterine ossific centers: (carpal bones)

* 1st year of life capitulum, hamate.

* Then Number of ossific centers = Age (years) + 1 till the 6th year (7 ossific center). The 8th (last) ossific center appears between 10-12 years old.

Delayed bone age	Advanced bone age
- GH ↓ - Hypothyroidism - Malnutrition - Chronic illness - Constitutional	- GH ↑ - Hyperthyroidism - Simple obesity

7- Special Senses

Hearing:

- Birth → Hearing is hindered by amniotic fluid filling the tympanic cavity.
- 2nd week → Good hearing and responds to sound stimuli by Moro reflex
- 6 months → Turning head to sound.

Vision:

- 1st month → No fixation as the maculae are not well developed.
- 2nd month → Fixation on steady source of light.
- 3rd month → Follows slowly moving object with his eyes.
- 6th month → Follows rapidly moving object with his eyes.
- Binocularity of vision depends primarily on the adequate coordination of the extraocular muscles and is normally established by 3-6 months of age.

8- Vital Signs

* Heart rate: (Beat/minute)

- Birth → 120 - 140 - 2nd year → 100
- 4th year → 90. - 6th year → 80

* Blood pressure:

- At birth → 70/50, ↑ 10 systole and 5 diastole every 3 years.
- So 3 yrs (80/55), 6 yrs (90/60), 9 yrs (100/65), 12 yrs. (110/70).

* Respiratory rate:

- At birth up to 60/min.
- During the first year 35-45/ min.
- During the second year 25-35/min.
- During the 8th year 20/min

9- Growth Charts

❖ Definition:

(Arranging a particular child in comparison to other children of the same age & sex).

❖ Types of growth charts:

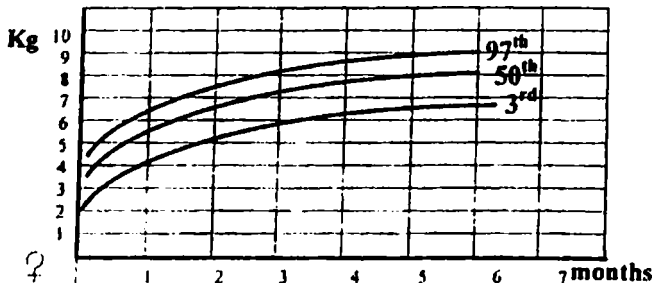
1- Centile curves

- They are graphic presentation of patterns of growth.
- For every character of growth (Height, weight,) the chart includes the centiles (3rd, 5th, 95th, 97th,) indicating the deviation of the values above or below the mean (the 50th centile-the commonest value for age).

Example: In body weight for age chart for boys at the age of 4 months the value 6Kg lies at the 50th centile (The mean value).

☞ N.B.:

- Values below 3rd centile or above 97th centile are considered abnormal.
- e.g. If body weight for child aging 4 months is 4 Kg (Below the 3rd centile) the child is referred as low body weight.



2- Centile tables:

The same data of centile curves are present in tables representing the 3rd, 5th, 50th, 95th and 97th centiles for each character (for age & sex).

Weight	3 rd	5 th	25 th	50 th	75 th	95 th	97 th
Birth	2.46	2.54	3.00	3.27	3.64	4.15	4.32
1 month	3.00	3.16	3.82	4.29	4.75	5.38	5.51
2 month	4.31	4.43	5.32	5.98	6.56	7.37	7.49

3- Growth velocity curves:

To determine the rate of growth per time unit (e.g. 3, 6, 12 months) for the same individual. This requires 2 measures to the same person with known time interval.

4- Growth distance curves

❖ **Examples of growth charts:**

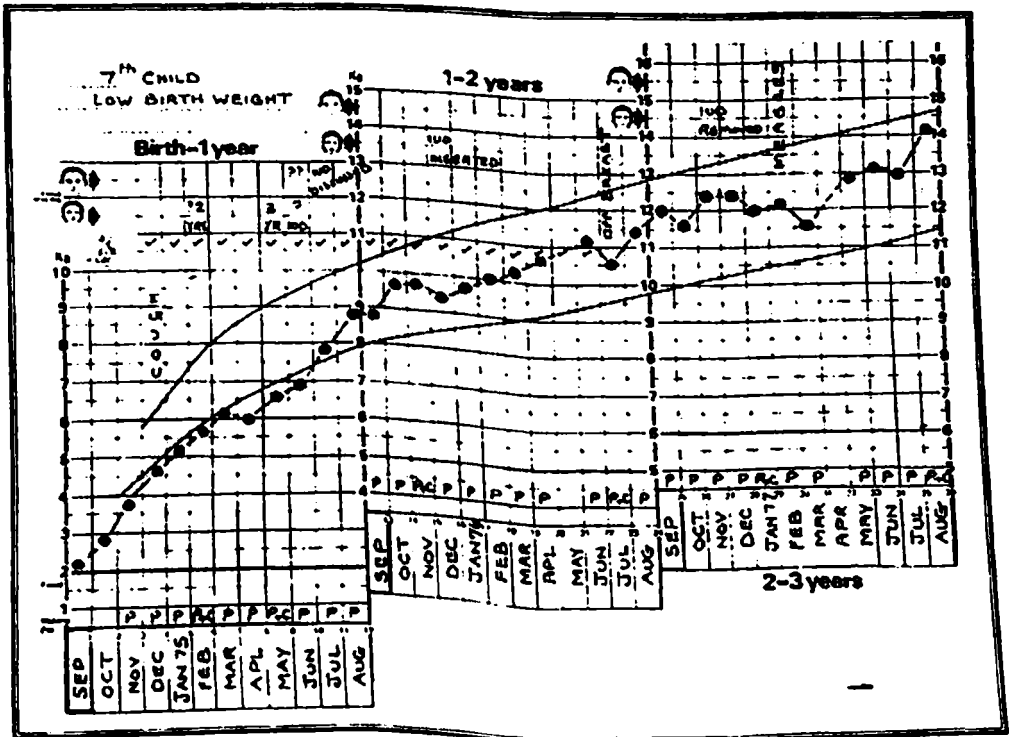
- 1- Weight/Age chart. 2- Length/Age chart. 3- Weight/Length chart.
4- Morale's chart.
5- All measures of the body and developmental characters have specific charts (curves).

❖ Value of growth charts:

- 1- Detecting abnormal children for investigations.
- 2- Easy method for assessment of growth.
- 3- Early detection of PEM (flat curve) and monitoring of success of therapy.
- 4- For research purposes.

N.B. :Road to health weight chart (Moraley's chart)

- 1- Used only for the first 3-5 years of life and for both sexes.
- 2- There are only two curves.
- 3- Spaces are available to record feeding, vaccinations and any disease.
- 4- Kept with the mother for follow up.



IMPORTANT NOTES ON GROWTH AND DEVELOPMENT

* Sphincteric control:

Achieved at any time from 1.5-4 years depending on:

- CNS maturation.
- Muscular development of sphincters.
- Training.

* Puberty:

• **Def.:** → Beginning of sexual maturation.

• **Stages:** →

Male

Begins at 12-14 years

- 1- ↑ size of testis
- 2- Scrotal pigmentation
- 3- Penile growth
- 4- Pubic hair.
- 5- Axillary hair.
- 6- Change of voice.
- 7- First seminal discharge.

Female

Begins at 10-12 years

- 1- Breast bud.
- 2- Pubic hair.
- 3- External genitalia growth
- 4- Axillary hair.
- 5- Menarche.

• **Abnormal puberty:** →

I- Delayed Puberty

- Defined as: no sexual maturation by the age of 15 years in boys and 14 years in girls.
- The most common causes are constitutional but exclusion of other causes (as Turner in female and Klinefelter in male) is essential.

II- Precocious puberty

- Defined as: Appearance of 2ry sexual characters before 8 years in girls and 9 years in boys.

True precocious puberty

- Both 2ry sexual characters and gonads are developed.
- Commonest causes are:
Constitutional and organic brain lesions e.g. tumours.

Precocious pseudapuberty

- Only 2ry sexual characters are developed.
- Commonest causes are:
Hormone secreting tumours.

CHAPTER (II)

INFANT FEEDING

TYPES OF INFANT FEEDING:

- 1- **Breast feeding:**
 - Mother
 - Wetnurse
 - Breast milk banks (not allowed)
- 2- **Artificial feeding:**
 - Fresh animal milk
 - Evaporated and condensed milk
 - Dried powdered milk.
- 3- **Mixed feeding:**
 - Complementary In each feed begin with breast and completed by artificial.
 - Supplementary Substitution of one or more complete feeds by artificial feeds.

BREAST FEEDING

Physiology of Milk Production

I- Stages of milk production:1- *Preparation of the breast:*

High levels of progesterone and estrogen during pregnancy leads to hypertrophy and hyperplasia of the glandular and ductal systems of the breast.

2- *Initiation of milk flow:*

Sudden drop of sex hormones after delivery of the placenta releases the pituitary from their inhibition so, prolactin is secreted and initiates milk flow.

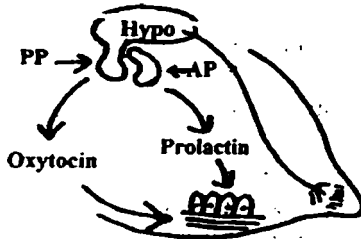
3- *Maintenance of milk flow:*

- *Mechanical factors:* Immediate regular suckling with complete and regular evacuation are the most important factor for maintenance of milk flow.
- *Nutritional factors:* Adequate maternal diet and fluids are necessary, however the composition of breast milk (except fat and some vitamins) is not affected by diet.
- *Hormonal factors:* State of hormonal balance is necessary (Sex hormones, Prolactin, Oxytocin, Thyroxine and GH)
- *Psychological factors:* Fear, anxiety and worry all affect the milk ejection reflex as catecholamines stimulate prolactin inhibitory factor from hypothalamus.
- Lactagogues are factors that enhance milk secretion, they include:
 - nutrition (CHO, Ptn, Fluids, Vit. B complex, ...).
 - Fungreek.

I. Control of milk production:

Maternal reflexes

- 1- **Milk production:** (production reflex)
Suckling → nipple → vagus nerve → hypothalamus → Ant. Pituit. → prolactin → stimulation of milk secretion.
- 2- **Milk ejection:** (let down reflex)
Suckling → nipple → vagus nerve → hypothalamus → post. pituit. → oxytocin → contraction of myoepithelial cells around the acini → Milk ejection



Infant reflexes

- 1- **Rooting reflex:**
The infant turns his head to the side in which nipple is felt then the nipple is settled in the mouth then to oropharynx by the action of buccal muscles.
- 2- **Suckling reflex:**
Rhythmic movements of the mandible applying pressure on the lacteals under the areolae, leading to expression of breast milk.
- 3- **Swallowing reflex.**
- 4- **Satiety reflex:**
by full stomach.

Composition of Breast Milk

Composition of breast milk varies according to the time of delivery:

- 1- Colostrum ⇒ before birth to the 4th day of life.
- 2- Transient milk ⇒ from the 5th, to the 21st day after delivery.
- 3- Mature breast milk ⇒ after the 21st day.

	Colostrum	Mature Breast Milk
○ Viscosity	• Thick	• Thin
○ Specific gravity	• 1040-1060	• 1030-1035
○ Daily amount	• 40-60 ml	• 1 litre
○ Colour	• Lemon yellow	• White
○ Caloric value	• 67 cal/dl	• 67 cal/dl
○ Composition	• Ptn. → 2.2% • Fat → 3% • CHO → 4% • Ashes → high	• 1.2 % • 4 % • 7 % • 0.25 %
○ Colostrum corpuscles	• Present (Large endothelial cells derived from breast acini).	• Absent (if present it indicates bad prognosis of milk secretion).
○ Clinical value (function)	• ↑↑ protein → ↑ Nutritive. • ↑↑ IgA → ↑ protective • Initiates gastro-colic reflex (so some laxative effect).	• All functions and advantages of breast milk (Discussed later)

NB: Preterm milk:

- * It contains 20 % more protein, ↑Ig , ↑lactoferrin , ↑enzymes
And contains acetyl hydrolase and IL-10 → protect against NEC
- * It has 40-50% higher in fat, ↑LCPUFA, needed for brain and 15% ↓ in lactose
- * It has ↑ Na, Cl, K, P, Mg and Ca
- * vit A, E are consistently higher
- * It has higher levels of certain anti-infective properties, especially ones that protect babies against gastrointestinal and respiratory infections.

Advantage of Breast Feeding

I- To the mother

- Not need preparation, available at any time.
- Lower incidence of cancer breast.
- Involution of the uterus and birth canal after delivery, so guards against post partum hge.
- No cost.
- Prevents milk engorgement.
- Natural method of contraception.

II- To both mother and infant:

Helps emotional security of infant and mother and establishes strong psychological relationship between them.

III- To the infant:

A- General Advantages:

- Sterile and free from contamination.
- Adequate amount (Quantity).
- Adultration can not be done.
- Colostrum is very essential for the newborn and contains all types of immunity.
- Constant temperature.
- Soothing effect on GIT.
- Adequate composition (Quality).
- Allergy is rare.

B- Composition:

The composition of breast milk is ideal for infant feeding in contrast with animal milk.

1- Quantitative differences between human and animal milks:

Constituent/100ml	Human	Cow	Buffalo	Goat	Ass
- Water (g)	88	87	85	87	89
- Protein (g)	1.2	3.5	4	4	1.5
- Fat (g)	4	4	6	4	3
- CHO (g)Lactose	7	4.5	4.5	4.5	6
- Total minerals (g)	0.25	(up to 0.75)			
- Ca (mg.)	30	120			
- Ph (mg.)	15	90			
- Iron (mg.)	0.15	0.05			
- Vit. A,B	Sufficient in all types				
- Vit. C	± 50 mg (variable with mother intake)	(± 10mg only due to boiling)			
- Vit. D	Deficient in all types				
- Energy (Calories)	67-70	67-70	76	60	67

2- Qualitative differences between human and cow's milk:

	Human milk	Cow's milk
1- Protein		
- Curd	* Small amount, fine and thin so easily digested	* Large amount, tough and thick so hardly digested.
- Dietetic protein		
* Soluble	- 60% (α -lactalbumin)	- 20% (Beta lactoglobulin)
* Insoluble	- 40% (casein)	- 80% (casein)
* S: I	- 3 : 2	- 1 : 4
- Non dietetic protein		
* Lactoferrin	- $\uparrow\uparrow$ (Bacteriostatic to E.coli) ($\uparrow$ absorption of Iron)	-Traces
* Lysozymes	- $\uparrow\uparrow$ (Bactericidal)	-Traces
* Immunoglobulins	- $\uparrow\uparrow$ (Specific to human diseases)	-Traces (specific to animal diseases)
* Glutamic amino acid	- $\uparrow\uparrow$ (Essential for brain development.)	-Traces
2- Fat		
- Fat globules	- Small	- Large (Hard digestion)
- Diurnal variation	- Present ($\uparrow\uparrow$ concentration at the evening and end of feed)	- Fixed concentration
- Lipase	- $\uparrow\uparrow$ (so good absorption)	- $\downarrow\downarrow$ (1/10)
- Volatile F.A.	- Small amount	- $\uparrow$ 7 times (GIT upsets / regurgitation / abd. distention)
- Essential FA (LCPUFA)	- High (11%) esp. linoleic	- Small < 2%
3- CHO		
	- β lactose No fermentation (No gases - No vomiting) - Some is converted to lactic acid: * $\uparrow\uparrow$ Ca absorption. * Bacteriostatic	- α Lactose with $\uparrow$ incidence of fermentation (excess gases, vomiting)
4- Minerals		
- Amount	- $\downarrow\downarrow$ to avoid hyperosmolarity & renal overload.	-High
- Ca/P ratio	-2/1 so better absorption (Rare rickets)	-4/3 so less absorption ($\uparrow$ rickets despite $\uparrow$ Ca)
- Na content	-Low so $\downarrow$ renal solute load	-High
- Iron	-Low with good absorption (rare Iron deficiency anemia)	- Very low with bad absorption. ($\uparrow$ Iron deficiency anemia)
5- Bacterial content	-Sterile	- High, especially if not well boiled

C- Anti-Infective property (Immunity):

1- Cellular:

Human milk is a live fluid contains 4 million cells per ml colostrum, the most important cells are leukocytes esp. neutrophils, macrophages, and epithelial cells. These cells have a role in infant protection against pathogens, also cytokines as TNF- α & interleukins (secreted by lymphocytes) are important in disease prevention. Interleukins (IL) present in breast milk may:

- enhance T-cell production (IL-1 β) - $\uparrow$ IgA production (IL-6)
- attract PNL's (IL-8) - inhibit pro-inflammatory agents (IL-10).

2- Humoral:

- Small amount of IgG, IgM for passive immunity but high amount of secretory IgA is present in breast milk (for GIT and respiratory protection), as the infant has low levels of IgA in the first year of life.
- Immunity against polio: some authors recommend stoppage of breast feeding 2 hrs before and after polio vaccination to prevent interference with Ab's in milk.

3- Others:

- Antistaph factor: Unsaturated fatty acids prevent the growth of staph.
- Antiprotozoal: Lipase enzyme has a role in destruction of giardia and amoeba when stimulated by infant bile salts.
- Antiviral activity: Interferon (secreted from lymphocytes)
- Lactose (Bifidus factor): inhibits growth of E-coli and vibrio-cholera in colon by changing to lactic acid so $\uparrow$ growth of acidophil bacteria (e.g. lactobacillus bifidus)
- Lysozyme: Lyses of bacterial cell wall (bacteriocidal).
- Lactoferrin, B12 binding protein & Folate binding protein: All of them bind nutrients so deprive bacteria from these growth factors (bacteriostatic).
- fibronectins act as opsonine.
- mucins are anti-rota virus and receptor analogues.
- oligosaccharides act as receptor analogues inhibit binding of enteric & resp. organisms and their toxins to m.m.
- Low buffering capacity: Neutral or slight alkaline so preserve HCL in the stomach to kill bacteria.
- Low content of inflammatory mediators and high content of antioxidant are present in human milk which minimize tissue damage.
- Low incidence of NEC due to the presence of platelet activating factor acetyl hydrolase (deficient in animal milk).
- Low incidence of otitis media and respiratory infections.

D- Other advantages of breast milk (Recently discovered):

1- Growth factors and Hormones:

- The concentration of many growth factors and hormones is higher in woman's milk than her plasma.
- Some components of breast milk can't be synthesized by the newly born and are essential for growth as: carnitine, taurine, casomorphins, epidermal growth factors and LC-PUFAs.

2- Enzymes:

- Human milk contains a great number of enzymes.
- Functions of milk enzymes are either transport function (xanthine oxidase for iron and glutathione peroxidase for selenium) or digestive functions (amylase, lipase,.....) which compensate for immature pancreatic functions of the newborn.

3- Bioactivity of human milk:

Despite of relatively low concentration of some nutrients, human milk is considered superior than others, either by better absorption (e.g. Iron) or suitable ratio as Ca/Ph

4- Long term effects of breast feeding:

Human milk is not only beneficial during infancy, but also may protect the child from diseases that develop at later ages e.g. Crohn's disease, diabetes mellitus and lymphomas, also cognitive development is better in breast than artificially fed child.

Unfavorable aspects of Breast Milk

(Very Rare)

- 1- Breast milk allergy → very rare.
- 2- Some maternal drugs are secreted in milk as → atropine, antithyroids, antibiotics, barbiturates, bromides, sulpha, salicylates and laxatives.
- 3- Pregnanediol secreted in milk → breast milk jaundice.
- 4- Deficient in iron, vitamin D and K.
- 5- Potential transmission of some viruses e.g. CMV, AIDS,.....

Management of Breast Feeding

I- Practical aspects of breast feeding:

A- Ante natal period:

- 1- Proper maternal nutrition during pregnancy.
- 2- Nipple care (repeated pulling out during last trimester).
- 3- Health education of the mother for protection from false beliefs:
 - Breast milk has no allergy.
 - Ability of breast fed does not depend on breast size.
 - More suckling by day and night = more milk.
 - No supplementary milk even with few amount colostrum.

B- After delivery:

- 1- Allow the baby to suckle as soon as possible.
- 2- Allow the baby to suckle whenever he wants.
- 3- No extra fluids except water (by spoon) in hot weather.
- 4- Proper maternal nutrition during lactation.
- 5- Inform the mother that milk ejection from contralateral breast during lactation is a sign of satisfactory nursing.

II- Technique of nursing:

A- Prenursing measures:

- Wash maternal hands and nipples.
- Mother sits comfortably on a high seat.
- Baby is held in semisitting position supported with the arm of the same side of the given breast.

B- Nursing measures:

- Breast is held with the free hand with the nipple between index and middle finger.
- The nipple including the periareolar area is introduced inside the mouth.
- Breast should always be held away from nostrils.

C- Post nursing measures:

- Clean the breast and place sterile dressing on the nipple.
- The baby should be eructated twice.
- After feeding put the baby on his side (not back).

III- Adequacy of feeding:

A- Assessment of adequacy:

- Clinical criteria

- * Steady weight gain.
- * Sleep 2-3 hours after feeding.
- * Good bowel habits.
- * Good urine flow.

-Maternal signs of good milk supply

- *Let down reflex.
- *Marked filling of breasts between feeds.

- Test feed:

Infant is weighted before and after feeding with unchanged clothes to calculate the amount of feed for 3 days then take average.

• If test feed:

- ≥ Requirements → continue breast feeding
- < Requirements → add formula feeding

-Test weight:

- The infant is weighted every 4 days with the same clothes.
- Normally the increase in the weight should be > 100 gm.

N.B.:

- In test feed the requirements/ feed is calculated as such:

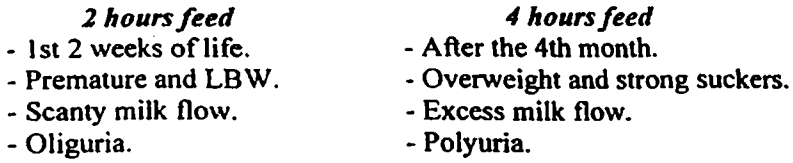
- Requirements/feed: → Days → age (days) × 10
 → Weeks → Age (weeks) × 10 + 70
 → Months → Age (months) × 10 + 100

B- Under and over feeding:

	Under feeding	Over feeding
Manifestations	- Inadequate weight gain. - Lack of satisfaction after feeding (↑ cry and ↓ sleep) - Constipation. - Oliguria. - Suckle his fingers. - ± Dehydration.	- Excess weight gain. - Lack of satisfaction after feeding (irritability) - Diarrhea and colic. - Polyuria. - Vomiting. - ± Sore buttocks.
Management	- Examine the infant for the cause of ↓ suckling. - Examine the mother for the cause of ↓ milk. - If no cause → milk supplementation.	- Feeding only every 4 hours. - No suckling > 20 min/ feed. - Remove excess breast milk by pump after feed.

IV- Intervals between feeds:

Normally the infant feeds whenever he wants (usually 3 hours intervals)



Difficulties (Problems) of Breast Feeding

I- Difficulties related to the mother

1- Delayed appearance of milk:

Especially after Cesarean section or shocky labour.

TTT → - Insist on breast feeding and put the infant on breast.

2- Scanty milk supply:

Due to → - Maternal malnutrition, diseases or psychic troubles.

- Early administration of sugary fluids → ↓ suckling.

- Work - contraception - pregnancy - twins.

TTT → - of the cause. - Lactagogues → see before.

3- Milk engorgement: (Tender full breast):

- Mild (overload): *ttt* → Increase infant suckling ± Manual expression.

- Moderate (engorgement): *ttt* → Manual expression ± Breast pump.

- Severe (obstruction): *ttt* → Temporary stoppage of milk secretion (estrogen tab)

4- Retracted nipple:

Due to → Lack of antenatal care.

TTT → Using special glass or plastic shields.

5- Cracked (fissured) nipple:

Due to → - Lack of antenatal care.

- Leaving the nipple wet.

- Suckling empty breast.

TTT → - If unilateral stop feeding from the fissured side with regular evacuation and the nipple is painted with lanolin or panthenol (about 24 hrs.)

- If bilateral temporary stoppage of breast feeding may be needed.

6- Acute mastitis and breast abscess:

Due to * Predisposing factors: - Milk engorgement

- Fissured nipple

* Organism: Mainly staph.

TTT → In mastitis → stop lactation from affected side + evacuation + antibiotics.

→ In abscess → stop lactation from both sides + incision + antibiotics.

7- Large pendulous breast:

To guard against infant suffocation the mother must support the breast during feeding and never allow lactation from sleeping mother.

8- Work and lactation:

* Worker mothers are advised to feed their infants just before leaving for work and just after returning and if work time is more than 4 hours → supplementary feed.

* Milk can be collected by a pump and stored (24-hours in refrigerator).

9- Contraception and lactation:

Estrogen containing contraceptive pills decrease milk flow so progesterone pills and intrauterine device are more suitable.

10- Pregnancy and lactation:

No harm of lactation during pregnancy with adequate maternal nutrition but after the 24th week of gestation milk changes to colostrum and most mothers prefer to wean.

11- Twins and lactation:

- Must be followed by weight for age chart.
- If there is no adequate weight gain supplementation is advised.

II- Difficulties related to the infant

1- Congenital anomalies:

Cleft lip, cleft palate, macroglossia, tracheo-esophageal fistula and pylorospasm.

2- Weak suckling or swallowing:

Prematurity, intracranial Hge., facial palsy and mental deficiency.

3- Painful mouth conditions:

Stomatitis, glossitis, oral moniliasis and ulceration.

4- Dyspnic conditions:

All causes of respiratory distress (e.g. pneumonia, effusion, nasal obstruction,).

5- Habitual vomiting:

- Due to aerophagia helped by physiological weakness of the muscles of cardiac sphincter.
- TTT
 - The infant must be eructated twice before sleep.
 - If frequent shocking, few seconds of rest must be allowed every now and then.

6- Constipation:

- * Normal breast fed baby may pass stool every 2-3 days with comfort but it is not constipation which means hard stool which pass with straining and discomfort.
- * Causes → underfeeding and excess demands (e.g. Hot weather or ↓ fluid intake).
- * TTT → * Causal TTT * ↑ fluid intake * Rectal enema if needed.

Contraindications of Breast Feeding

I- Maternal causes contraindicating breast feeding

* Temporary

- Acute maternal illness e.g. typhoid, septicemia,
- Bilateral cracked nipple, mastitis or breast abscess.
- Acute maternal drug intake e.g. laxatives, tetracycline,

* Permanent

- Chronic maternal diseases. (chronic chest disease, decompensated rheumatic heart, uncontrolled DM, TB, \$)
- Local breast causes e.g. cancer breast.
- Mental and neurological diseases e.g. epilepsy, mania, post partum psychosis.

☞ N.B.:

- \$→ Syphilitic mother usually has an infant with \$ so may feed her infant who received penicillin for 2 weeks.
- Mental deficiency→ can feed her infant under observation.
- T.B.→ * Prophylactic INH for the baby (15 mg/kg/day) and the mother uses a mask during lactation or express her milk and feed by bottle.
* At 6 months age tuberculin test is done if -ve the infant is vaccinated with BCG vaccine, if +ve treat as T.B.
- Cancer breast → * absolute contra indication for breast feeding.

II- Infant causes contraindicating breast feeding:

○ Temporary

- * Breast milk Jaundice.
- * Respiratory distress.
- * Complete cleft palate.
- * Prematurity (< 34 week gestation due to incoordination of suckling and swallowing).

○ Permanent

- * Milk allergy (very rare)
Manifested by: -Diarrhea vomiting, colic - Occult blood in stool.
- * Lactose intolerance:
- Due to lactase deficiency → (Persistent diarrhea)
- * Galactosaemia:
Galactose 1 phosphate $\xrightarrow{\text{Galactose 1 ph transferase}}$ glucose-1 phosphate.
if the enzyme is ↓↓, accumulation of galactose 1 phosphate after feeding
(eye → cataract, brain → MR, liver→ damage)
- * Phenyl ketonuria:
Phenylalanine $\xrightarrow{\text{phenylalanine hydroxylase}}$ tyrosine
↓↓ of the enzyme → M.R.

ARTIFICIAL FEEDING

- * **Indications:**
 - Contra indications to breast feeding.
 - Absent mother.
 - Absent milk in mother's breast.
 - Multiple pregnancy.
- * **Amount of milk needed:**
 - Age method → (see before)
 - Weight method →
 - * Each 100 ml of milk gives 67 - 70 calories.
 - * Infant needs 110 cal./kg/day (150 for PEM). So milk requirement/day
$$\frac{100 \times 110}{67} = 155-165 \text{ ml/kg/day.}$$
- * **Number of feeds/day:**
 - 0-4 months → feed every 3 hours (average 6 feeds/day).
 - 5-8 months → feed every 4 hours (average 5 feeds/day).
 - 9-12 months → feed every 5 hours (average 4 feeds/day).
- * **Types of artificial feeding:**
 - Fresh fluid animal milk.
 - Evaporated and condensed milks.
 - Dried powdered milks.

Fresh Animal Milk

- **Types:** → see before.
 - Buffalo's milk is the most commonly used in Egypt but fat content is high.
 - Cow's milk is the most commonly used world wide.
 - Goat's milk:

Advantages

- * ↑ Essential fatty acids.
- * Protein is easily digested.
- * Hypoallergic milk.!!!

Disadvantages

- * Low caloric value.
- * Low folic acid content so ↑ incidence of megaloblastic anemia.
- * High incidence of Brucellosis

○ Sterilization:

1- **Boiling:** Boiling of milk at 100°C for 10 minutes destroying all forms of pathogenic organisms but destroy some vitamins esp. vit. c and denaturates 25% of milk proteins.

2- **Pasteurization**

By heating milk below 100°C then sudden cooling and keep below 10°C.

3- **Autoclaving:** Milk is boiled to 120°C at 2 atmospheric pressure (Only used during milk born epidemics).

○ **Modification:**

1- **Humanization of cow's milk:**

- Dilution with boiled water so ↓ protein and minerals.

Age	Milk	Water
0 – 2 m	1	1
2 – 4 m	2	1
4 – 6 m	3	1

- Adding 5 grams of sugar to each 100 ml (↑ calories, ↑ CHO).
- Boiling of milk (modified ptn. curd and fat).
- Addition of few drops Vit.C or lemon juice.

2- **Peptonization:**

Partial digestion of proteins.

3- **Homogenization:**

Breakdown of fat globules.

Evaporated and condensed milks

- * Concentrated milk formulae by removal of water to half its size.
- * **Types**
 - Unsweetened type
 - Sweetened type
- * **Advantages:**
 - Stored for months without refrigeration.
 - Stable
 - Sterile

Dried Powdered Milks

- * **Advantages:**
 - Sterile
 - Stable in composition
 - Stored easily.
 - Fine curd (so easily digested)
 - Fortified with vitamins and minerals
 - Fresh.

* **Preparation of the feed:**

- * The bottle and teat used should be boiled for 5-10 minutes.
- * Calculated amount of water is poured in the bottle (by age or weight method).
- * When water temperature becomes suitable add the measures.
 - American milks (Begins with S) → 1 measure/60 ml water.
 - European milks (others) → 1 measure/30 ml water.
- * Close the bottle and shake well, and test the temperature of milk by pouring few drops on the dorsum of hand.

*** Types of dried milk:**

1- Full cream milk:

Full fat content (4%) e.g. Nedo, Francelait.

Indications: Full term infant after the 4th month.

2- Half cream milk:

Half fat content (2%) e.g. Nestogen 1/2 cream.

Indications: Full term infant before the 4th month.

3- Skimmed milk:

Fat is removed (< 0.5%).

Indications:

- Fat intolerance.
- Prematures and LBW.
- Start feeding in cases with PEM.

4- Humanized milks:

- Protein: modified to form small curds.

- CHO: sugar is added.

- Fat: Finely dispersed with substitution of some fat with vegetable mixtures to increase unsaturated fatty acids.

- Ca/Ph ratio: Modified.

- Vit.D, C and Iron: are added.

* Indications:

- Normal infants
- Large prematures (2-2.5 Kg).
- Mild degree malnutrition.

* Examples: -May be further classified according to suggested age into:

0-6 month: e.g. Celia 1, leptomilk 1

7-12 month: e.g. celia 2, primavita 2

After the 1st year: e.g. progress, similac gain 3

N B: Some of these formulas are enhanced by prebiotics e.g. oligosaccharides.

5- Acidified milks:

**** Methods of acidification:**

i- Chemical: By adding weak acid (as lactic acid).

ii- Biological: By adding fermentative bacteria e.g. lactobacillus acidophilus.

The biological method is preferred as growth of bacteria stops at certain pH (self regulation).

**** Advantages of acidified milk:**

- Requires less HCL for digestion so preserve HCL barrier against organisms.
- Modifies casein → small easily digested curd
- Increase calcium absorption from the gut.

**** Disadvantages of acidified milk:**

- Bad taste
- Acidosis
- Soreness of perineum (Low stool pH).

**** Example:** Elidon.

**** Indications:**

- As skimmed milk.
- Rarely used now due to high incidence of acidosis.

6- Protein Milk:

↑ Ptn. (4 %) and ↓ Fat (2.5%) and ↓ CHO (2.5%).

**** Indications:**

- Under weight and PEM.
- Convalescent from Gastroenteritis.

**** Disadvantages:**

- Expensive.
- Bad taste.
- Hardly digested (Large, tough curd)
- ↑ Urea load on the kidney (Hard excretion).

**** Examples:** Prolac and sustagen.

7- Special milk formulae:

- Lactose free milk in lactose intolerance or Aptamil LF.
- Phenylalanin free milk in phenylketonuria e.g. phenolac.
- Premature milk formula (80 cal/dl) e.g. similac neosure & Bebelac premature.
- Hypoallergic milk: in cow's or breast milk protein allergy e.g. Evaporated goat milk or substitution of protein by soya beans → Isomil.
- Elementary formula: Purified chemical elements (free glucose, AA, EFA, medium chain triglycerides) in malabsorption syndrome.
- Antireflux formula: Milk is thickened in the stomach to decrease reflux episodes e.g. Bebelac AR.

MIXED FEEDING

I- Complementary feeding:

- In each feed begin with breast and completed by artificial.
- Indications: Scanty milk flow.

II- Supplementary feeding.

- Substitution of one or more complete feeds by artificial feeds.
- Indications: Worker mother and twins.

• N.B.: Precautions in mixed feeding:

- Artificial milk should not be sweetened otherwise infant may hate breast milk.
- Holes for artificial milk should not be wide.
- Better choose humanized milk

Cow's Milk Protein Allergy (CMPA)

**** an adverse reaction to cows' milk resulting from an immunologic hypersensitivity to one or more milk proteins"**

**** It may be IgE mediated allergy or Non-IgE mediated allergy**

**** Prevalence : 1-3 % in general and 30% of atopic children.**

**** Clinical manifestations:**

GIT : -Vomiting -GERD -Colic -Malabsorption -Colitis. -GI bleeding. -Constipation. -Obstruction.	Respiratory : -Rhinnorrhea. -Sinusitis. -Cough. -Serous OM. -Wheezing. ' -Pulmonary infiltrates. -Heiner's syndrome
Dermatologic : -Eczema. -Urticaria. -Angiodema. -Contact dermatitis.	Hematological: - Anemia - Thrombocytopenia
Others : -Anaphylaxis -Shock -Conjunctivitis.	

**** Investigations:**

-Guaiac test

-Skin test for CMP

-RAST

-CBC , Total IgE

**** Treatment:**

-Stop Cow milk (and cow milk based formula)

-Hypoallergic milk formula e.g. goat's milk or Soya-based infant formula

-Recently Neocate LCP is based on 100% free amino acids considered 'non-allergenic'.

WEANING

Definition: Introduction of semisolid and solid foods beside milk.

When to start:

- ⊙ Usually started at 6 months of age.
- ⊙ Some prefer early weaning at 4 months (not recommended).
- ⊙ Never before 4 months (Infant enzymes for digestion are not well developed and milk is sufficient for infant needs during the 1st 4 months of life).

When to postpone:

- Hot weather.
- Convalescence from diseases.
- During teething.

When to complete: 1.5 - 2 years

Aim of weaning:

- Infant can't tolerate > 1 liter fluid/day.
- Training of GIT.
- Supply Iron, Vit. D and Vit. C.
- Compensate for ↑ infant demands.

Side effects of weaning:

- **Allergy:** May follow introduction of certain new foods e.g. fish, egg,
- **PEM:** Due to insufficient protein or calories in diet.
- **Colic:** Especially with excess carbohydrates.
- **Diarrhea:** Due to contaminated food.

How to carry on:

- Weaning should be gradual (new food is introduced in small doses and only one type of new food is introduced at time).
- Canned foods must be avoided.
- New foods should be strained or pursed.
- Attractive presentation is important (e.g. coloured plates, spoons)
- Possibility of spitting is expected. It dose not mean that the infant dislikes the food, he is only tasting it.

Postulated program for weaning:

6 months	→	Cereals, cornflower pudding & biscuits.
7 months	→	Rice milk pudding , rice & mashed fruits.
8 months	→	Vegetable soup in water & yogourth.
9 months	→	Vegetable soup in meat, beans.
10 months	→	Mashed liver & fish.
11 months	→	Chicken & rabbit.
12 months	→	Red meat.

+ egg and fresh animal milk are better postponed to the 2nd year of life.

CHAPTER (III) GENETICS

INTRODUCTION

- # **Genetics:** The branch of medicine dealing with inheritance, diagnosis and treatment of diseases resulting from gene defects or chromosomal anomalies.
- # **Chromosomes:** Double stranded DNA molecules carrying the genetic material imbedded in protein matrix (histone).
- # **Euploidy:** Normal number of chromosomes (i.e. 46).
- # **Aneuploidy:** Abnormal number of chromosomes.
- # **Diploid number:** Number of chromosomes in somatic cells = (2×23)
- # **Haploid number:** Half number of chromosomes (1×23) which occur in gametes.
- # **Triploidy:** Three times the haploid number (3×23) .
- # **Polyploidy:** Four times or more the haploid number.
- # **Monosomy:** Absence of one of a pair of chromosome.
- # **Trisomy:** Presence of extra chromosome.
- # **Gene:** Segment of DNA on chromosome.
- # **Genotype:** The arrangement of genetic material in the cell.
- # **Phenotype:** The effect of genotype in the appearance of the organism modified by the environmental effect.

STRUCTURE AND FUNCTION OF GENE

➤ Gene:

Gene is the unit of heredity, it is the segment of DNA responsible for the formation of particular protein or enzyme. These proteins and enzymes produced in the zygote determine whether he will develop into a normal or abnormal human being.

☛ **Example:** Tyrosinase enzyme deficiency results in lack of skin pigmentation in the body (albinism).

➤ The Genetic Material:

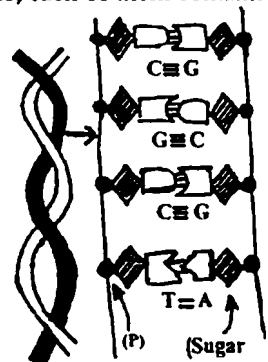
Each DNA (Deoxyribonucleic acid) is formed of two strands, each of them contains:

a- **Sugar:** Deoxyribose.

b- **Phosphate**

c- **Nitrogenous base**

- Four bases are available adenosine (A) & Guanine (G) & Thymine (T) and Cytosine (C).
- For each (A) base in a strand (T) base is present in the other strand and joined together by 2 hydrogen bonds, the same occurs between (C) and (G) bases but they are joined together by 3 hydrogen bonds.



⇒ Differences Between DNA and RNA (Ribonucleic Acid):

* DNA

- ⇒ Present in the nucleus.
- ⇒ Double stranded.
- ⇒ Sugar is Deoxyribose.
- ⇒ Nitrogenous bases (ATCG)

* RNA

- ⇒ In both nucleus & cytoplasm.
- ⇒ Single strand.
- ⇒ Sugar is ribose.
- ⇒ Uracil (U) instead of Thymine (T)

⇒ Types and Functions of RNA:

I- Messenger RNA (mRNA):

- ⇒ Long chains of RNA which form the template for protein synthesis.
- ⇒ Its molecular size and length is determined by the corresponding DNA.
- ⇒ Every 3 successive bases are called codon which codes for specific amino acid synthesis.

II- Transfer RNA (tRNA):

- ⇒ Short chains of RNA present only in cytoplasm.
- ⇒ Each tRNA molecule has 2 ends:
- One end is attached to particular amino acid, so 22 different types of tRNA are present corresponding to the 22 different A.A. in human cells.
- The other end of tRNA is called anticodon, which has specific sequence of 3 bases complementary to specific codon on mRNA.



III- Ribosomal RNA (rRNA):

- ⇒ Is found in ribosomes associated with protein and does not carry genetic information.

IV- Heterogenous RNA (Hn RNA):

- ⇒ It is the precursor from which mRNA is synthesized, so never leaves the nucleus.

⇒ Types of DNA:

- ① Repetitive DNA: Short or long repeated DNA sequences do not encode genes.
- ② Non-repetitive (unique) DNA: It contains sequences that code for mRNA and protein synthesis.
- ③ Mitochondrial DNA: 2-10 copies of double stranded DNA are present in the mitochondria.

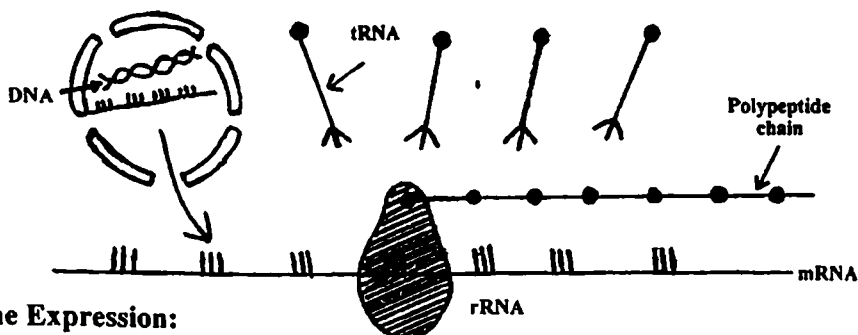
⇒ Functions of DNA:

① DNA replication and repair:

- ◆ Replication (duplication) of DNA occurs during preparation for cell division, in which the two strands of DNA separated and each one formed a complementary strand from materials in the surrounding media. This will result in formation of two separate DNA molecules.
- ◆ Repair means replacement of missed or broken segments of DNA strands by new segments after exposure to damaging insult e.g. after irradiation.

② Protein synthesis:

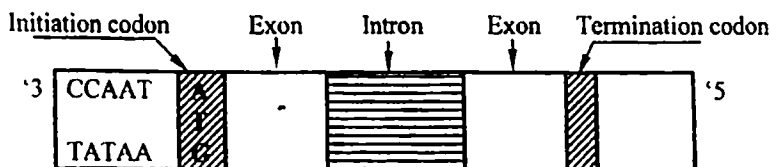
- i- **Transcription:** Synthesis of mRNA strand with the same sequence of bases of the original DNA strand (coding strand).
- ii- **The mRNA leaves the nucleus and becomes attached to the ribosome.**
- iii- **Translation:** Each 3 successive basis on DNA = 3 successive basis on mRNA (codon) so when the ribosomal RNA comes in contact with that codon the tRNA with specific anticodon complementary to it comes in place, leaving the specific amino-acid carried on it.
The mRNA moves and brings another codon in contact with rRNA, another tRNA comes in place and its amino acid will attach to the first amino acid. The process will continue until the whole polypeptide chain is formed.



⇒ Gene Expression:

* Human gene is composed of:

- **Exons:** The functional portions of gene sequences coding for protein synthesis.
- **Introns:** Non coding DNA sequences of unknown function.
- **Initiation codon:** Specific sequence (ATG) which determines the initiation of protein synthesis.
- **Termination codon:** Specific sequences (TAA, TAG or TGA) which determine the end of transcription.
- **TATAA and CCAAT boxes:** Special sequences with unknown function.



* Control of gene expression:

- ◆ Although all cells have the same DNA available to code for every cellular function, but each group of cells has special functions due to different expression of genes.
- ◆ This can be achieved by methylation theory which states that: Parts of the gene which is methylated tend to be non-functioning and non-methylated parts tend to be functioning.
- ◆ Mutation: Change in the sequence of bases of the gene, whether by addition or deletion of a base (non-sense) or substitution of base (mis-sense)

CELL DIVISION

I- Cell Cycle:

Cell cycle is a continuous process occurs in all living cells and dividing for interphase and mitosis.

➤ Interphase:

① *The first gap (G1 phase):* (5 hours)

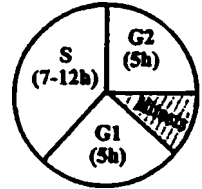
All DNA is present unreplicated.

② *DNA synthesis (S phase):* (7-12 hours)

Each chromosome is doubled and consists of two chromatids.

③ *The Second gap (G2 phase):* (5 hours)

Begins at the completion of S phase till the onset of mitosis.



➤ Mitotic division (M): (30 - 90 minutes)

◆ Definition:

A kind of cell division in which a cell with 46 chromosomes produces two daughter cells, each of them contains 46 chromosomes.

◆ Stages of mitosis:

1- Prophase:

⇒ Chromatin network of the nucleus resolves into individual chromosomes which condense and become visible under light microscope.

⇒ The nuclear membrane disappears.

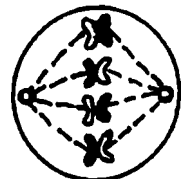
⇒ The centriole (extranuclear organelle) duplicates itself and its 2 products migrate towards the opposite poles of the cell.



2- Metaphase:

⇒ The chromosomes are deeply stained and arranged along the equatorial plane of the cell.

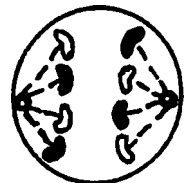
⇒ Protein fibers called the spindle radiate from the centrioles to the centromere of each chromosome.



3- Anaphase:

⇒ The centromere of each chromosome divides longitudinally and the sister chromatids separate forming 2 chromosomes.

⇒ The daughter chromosomes move to the poles of the cell by the action of contractile spindle fibers.

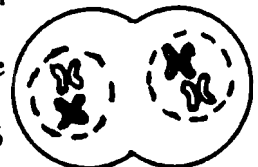


4- Telophase:

⇒ 46 daughter chromosomes reach each pole of the cell and begin to decondensate.

⇒ The cytoplasm divides and nuclear membranes are formed again.

⇒ At the end, interphase begins in each cell which has 46 chromosomes.



II- Meiotic Division:

> Definition:

A type of cell division occurs in gonads during gamete formation in which cell with diploid number of chromosomes (46) produces cells with haploid number of chromosomes (23).

> Stages of meiotic division:

A) *1st meiotic division (Reduction meiosis):*

① Prophase I:

- ⇒ Homologous chromosomes pair (synapse) along their entire length, so, corresponding DNA sequences comes into close physical proximity.
- ⇒ Recombination occurs between chromatids of homologous chromosomes through crossing over resulting in exchange of DNA segments between homologous chromosomes.

② Metaphase I:

- ⇒ Nuclear membrane disappears, chromosomes lie in the cell center.
- ⇒ The spindle fibres connect the centromere to the centrioles i.e. opposite pole of the cell.

③ Anaphase I:

- ⇒ The homologous (recombined) chromosomes separate from each other and move to the opposite pole of the cell.
- ⇒ The sister chromatids of each chromosome remains attached to each other (No centromere break).
- ⇒ The homologous chromosomes move to the newly formed cells randomly.

④ Telophase I:

- ⇒ The two haploid sets of chromosomes (i.e. 23) form two cells with unclear membrane and cytoplasm.

B) *2nd meiotic division (equational meiosis):*

Similar to mitosis but the mother and daughter cells contain 23 chromosomes instead of 46.

> Results and functions of meiosis:

- ① Reduction of chromosomal number (from diploid to haploid)
- ② Segregation of alleles.
- ③ Crossing over between homologous chromosomes, so that every new (recombinant) chromosome in the gamete will contain variable genes.
- ④ Random selection of homologous chromosomes at meiosis resulting in great variability between gametes.

> Differences between meiosis and mitosis:

- ① Meiosis occurs only in germ cells (Mitosis in all cells).
- ② The result of meiosis is reduction of chromosomal number to the half, but in mitosis the number of chromosomes in daughter cells is the same as mother cell.
- ③ Meiosis consists of two sequential cell divisions.
- ④ Synapses and recombination occurs only in meiosis.

MODES OF INHERITANCE

⇒ Definitions:

☆ **Alleles:** 2 genes at the same locus on homologous chromosomes.

☆ **Homozygous:** The individual with identical alleles.

☆ **Heterozygous:** The individual with different alleles.

☆ **Dominant inheritance:** The effect of specific gene appears either in homozygous or heterozygous state.

☆ **Recessive inheritance:** The effect of specific gene appears only in homozygous state.

⇒ Autosomal Inheritance:

Inheritance of characters carried on autosomes so both sexes can be affected.

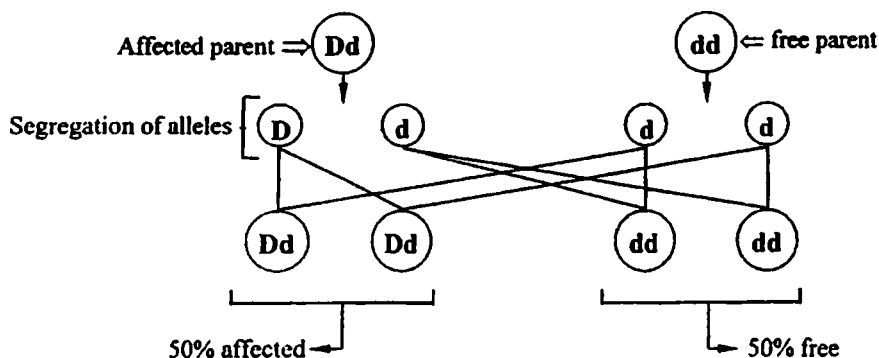
① Autosomal dominant inheritance: (AD)

⇒ Any affected person has an affected parent.

⇒ The trait is transmitted from affected person to half of his off springs.

⇒ The trait appears in all generations.

☞ **Example:** Achondroplasia, Von Willebrand disease.

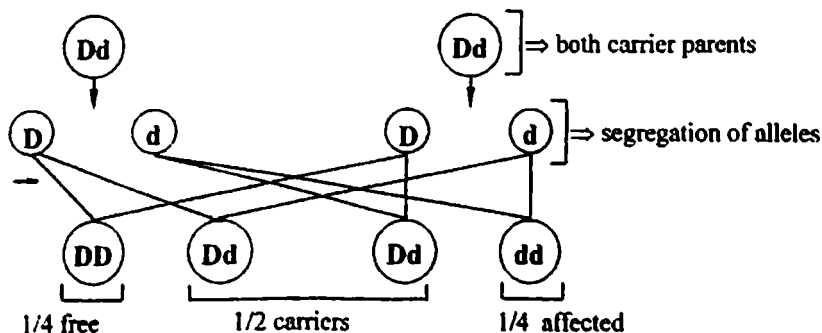


② Autosomal recessive inheritance: (AR)

⇒ Both parents are carriers (consanguinity may be present).

⇒ One fourth of the siblings are affected, one fourth are free and one half are carriers.

☞ **Example:** Most cases of errors of metabolism e.g. Albinism, Phenylketonuria.



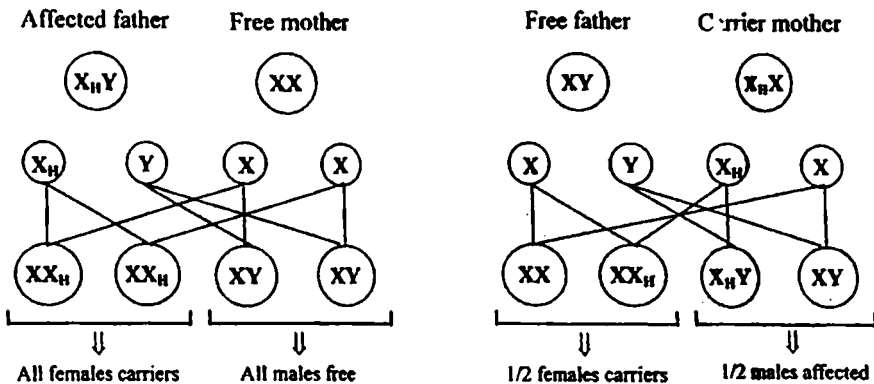
⇒ Sex Linked Inheritance:

Referred to inheritance of characters carried on X-chromosome, so differ according to sex.

① X-linked recessive inheritance: (XR)

- ⇒ The trait is expressed in all males carrying the gene but in females it is expressed in homozygous form only.
- ⇒ The affected father has all female off springs as carriers but never transmit the trait to his sons.
- ⇒ The carrier mother will have one half of her daughter carriers and one half of her sons affected.

☞ Example: Haemophilia A,B and G6PD deficiency.



☞ N.B.

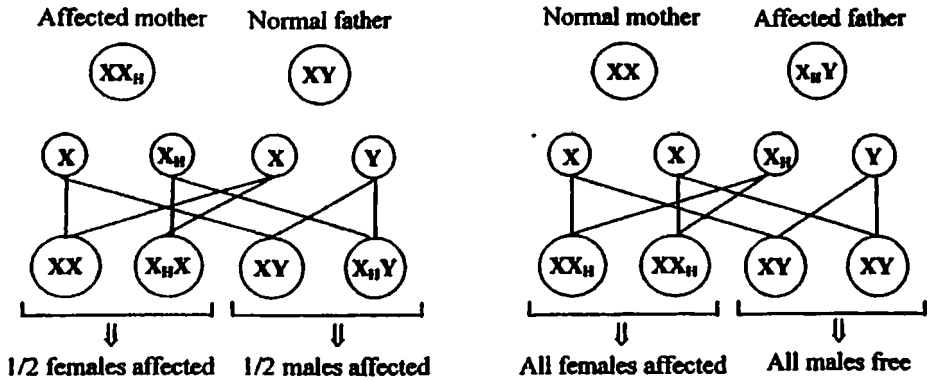
In X-Linked recessive transmission female can be affected if:

- 1- Marriage of affected male and carrier female.
- 2- According to Lyon theory: in XX female one X may be active and the other X is inert so XR trait may have mild effect in heterozygous female according to the degree of activation of affected X chromosome.
- 3- Female with only one X chromosome (Turner syndrome).

② X-linked dominant inheritance: (XD):

- ⇒ All persons carrying the gene whether male or female will express the trait.
- ⇒ Affected father will transmit the trait to all his daughters and never transmit the trait to his sons.
- ⇒ Affected mother will transmit the trait to half of her off springs either male or female.

☞ Example: Familial hypophosphatemic vitamin D resistant rickets, Rett syndrome.



II- Non mendelian modes of inheritance:

A) Multifactorial inheritance:

Multifactorial determined disorders are the product of multiple genetic and environmental factors, e.g. neural tube defect, cleft lip and cleft palate, DM and hypertension.

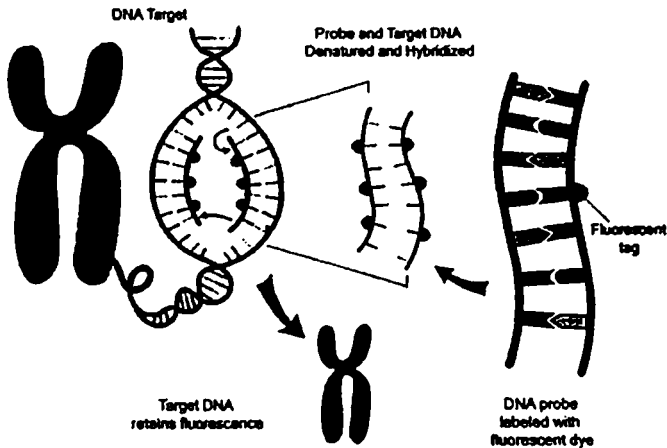
B) Non traditional modes of inheritance:

- 1- Mutations in mitochondrial DNA, e.g. mitochondrial disorders e.g. MELAS, MERRF.
- 2- Genomic imprinting: Certain regions of the genome are inherited differently depending on parent of origin. Genes are functionally inactivated (imprinted) during gamete formation and remain inactive in zygote, e.g. Prader Willi Syndrome & Angelman Syndrome.

■ Methods of molecular diagnosis of genetic disorders:

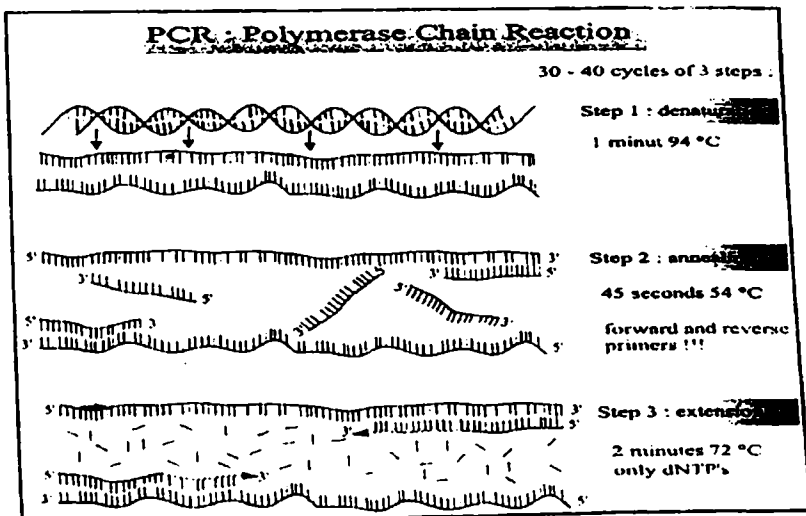
1- Conventional chromosomal analysis.

2- FISH method (Florescent In Situ Hybridization): using of unique DNA sequence as a probe to target DNA sequence of patient sample. The specified DNA probe is labeled with a tag (fluorochrome) allowing its detection through fluorescence microscopy.



3- Southern blotting method: genomic DNA is isolated from the patient and then cut into small fragments by restriction enzymes, these fragments are hybridized against radio-labeled known gene probes. Mutations can be detected by change in the length of DNA fragments.

4- Polymerase Chain Reaction (PCR): it's the most sensitive method for molecular diagnosis because it can detect even point mutations and micro deletions depending on amplification of DNA small fragments.



CHROMOSOMAL ANALYSIS (Karyotyping)

⇒ Definition:

Chromosomes can be isolated and analyzed by special maneuvers for diagnostic purposes especially on metaphase or prometaphase.

⇒ Preparation of Cells:

Viable dividing cells can be obtained from:

- ① **Peripheral blood lymphocytes:** Used for routine karyotyping.
- ② **Bone marrow:** for rapid analysis and in leukaemia.
- ③ **Skin fibroblasts:** In suspected mosaicism or if blood is not available (e.g. post mortem).
- ④ **Amniotic fluid cells:** For prenatal diagnosis of chromosomal anomalies.
- ⑤ **Buccal mucosa for sex chromatin:** It is an initial test to identify sex anomalies.

⇒ Techniques:

- ① **G-Banding:** using Trypsin/Giemsa stain and examined under light microscope in metaphase.
- ② **High resolution banding:** As G banding but examination of the chromosomes is done in prophase or prometaphase.
- ③ **Q-banding:** Using quinacrine stain and examination under fluorescence microscopy.
- ④ **Other techniques:** A lot of methods are used. e.g. -R banding - C banding.

⇒ Medical Applications:

- ① Confirm clinical diagnosis.
- ② Females with short stature of unknown origin.
- ③ Mental retardation of unknown origin.
- ④ Dysmorphic features.
- ⑤ Delayed puberty.
- ⑥ Ambiguous genitalia.
- ⑦ Parents of child with chromosomal anomaly.
- ⑧ Parents with 2 or more abortions of unknown cause.
- ⑨ Amniocentesis for mother with previous child with congenital anomalies and
- ⑩ Amniocentesis for mothers > 35 years old.

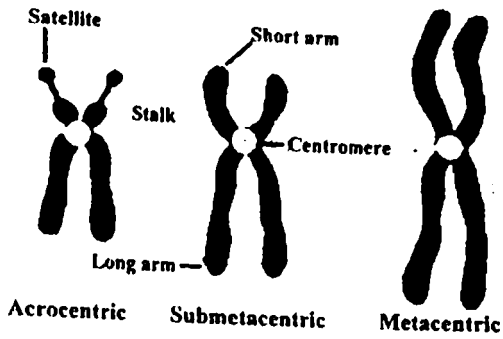
⇒ Classification of Chromosomes:

* Chromosomes are classified regarding:

1- **Size:** short - medium sized - long.

2- **Position of centromere:**

- **Metacentric** → Central centromere (Both arms are equal).
- **Submetacentric** → Slightly displaced from the center.
- **Acrocentric** → centromere is close to one end (very short P, very long Q).



* **Denever classification of chromosomes:**

A- 1,2,3	→ Large	+ Metacentric.	M
B- 4,5	→ Large	+ Submetacentric.	S
C- 6→ 12 & X	→ Medium	+ Submetacentric.	S
D- 13, 14, 15	→ Medium	+ Acrocentric.	A
E- 16, 17, 18	→ Short	+ Submetacentric.	S
F- 19, 20	→ Short	+ Metacentric.	M
G- 21, 22 & Y.	→ Short	+ Acrocentric.	A

MUTATIONS

Definition: any change in DNA sequence.

Types of mutations:

- 1- Point mutation: change in a single base pair
- 2- Deletions or Insertions: in which one or more base pairs are deleted or inserted into DNA sequence.
- 3- Tandem repeat mutations. Repetition of series of identical triplets (CGG CGG CGG.....) leading to gene inactivation.

Consequences of mutations:

A- consequences of point mutations

- 1- Silent mutation no change in the specified amino acid
- 2- Missense mutation: different amino acid is produced
- 3- Non sense mutation: terminate the polypeptide chain formation at this point

Original DNA Template Strand

TACTGGGTGCTACCCACT
AUGACCCACGAUGGGUGA

Peptide

Met	Thr	His	Asp	Gly
-----	-----	-----	-----	-----

Missense mutation

TACAGGGTGCTACCCACT
AUGACCCACGAUGGGUGA

Peptide

Met	Ser	His	Asp	Gly
-----	-----	-----	-----	-----

Frameshift mutation

TACGGGTGCTACCCACT
AUGCCACGAUGGGUGA

Peptide

Met	Pro	Thr	Met	Gly					??
-----	-----	-----	-----	-----	--	--	--	--	----

B- Change in function of the protein produced:

- 1- Mutations causing gain of function (over expression of the gene): (e.g. achondroplasia and peroneal muscle atrophy)
- 2- Mutations causing loss of function: under expression of the gene product (e.g. most commonly in AR disorders).
- 3- Mutations giving a unique property to the produced protein without altering its normal function (e.g. sickle cell disease)
- 4- Oncogenes: mutations causing cancer. Mutations can cause cancer if affected protooncogenes, tumor suppressor genes, genes of apoptosis or cell cycle control proteins.

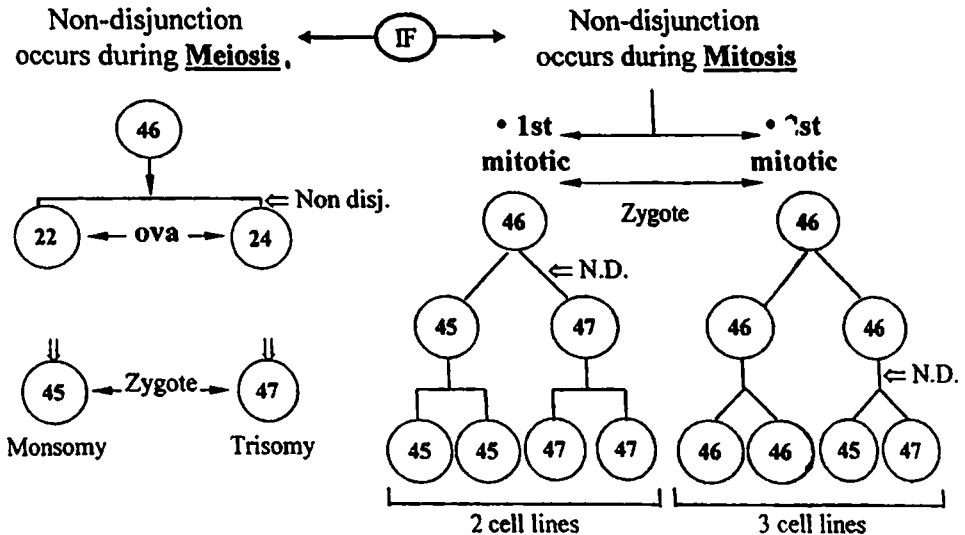
CHROMOSOMAL ANOMALIES

● Causes of Chromosomal Anomalies:

- 1- Old age of the mother (> 35 years old).
- 2- Genetic predisposition to non-disjunction.
- 3- Induced by radiation, chemicals, viruses or autoimmune damage in prenatal period.

● Numerical Chromosomal Anomalies:

Results mainly from non-disjunction which means failure of separation of two homologous chromosomes during the anaphase of meiotic or mitotic divisions, leading to formation of 2 daughter cells one with extrachromosome & one with less chromosome.

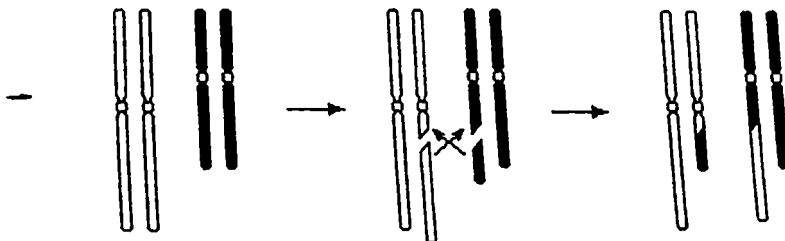


● Structural Chromosomal Anomalies:

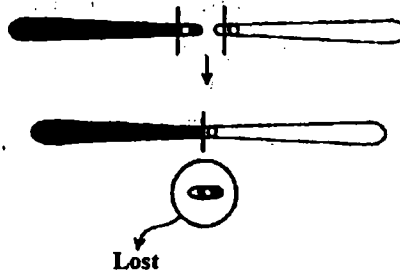
I- Translocation:

- ⇒ (A part of chromosome is broken and joined to another chromosome).
- ⇒ If translocation occurs in individual without genetic material loss it is called balanced translocation which is only problematic in gametogenesis.
- ⇒ Translocation may occur between non homologous or homologous chromosomes.
- ⇒ Types of translocation:

- A- Reciprocal translocation: Interchange of broken pieces from one chromosome to another but still balanced.



- **B- Robertsonian translocation** :It occurs between two acrocentric chromosomes. Unequal interchange between the chromosomes occurs after breaks near the centromeres leading to one big chromosome (2 long arms) and one short (2 short arms which is lost).e.g. balanced translocation carrier mother in Down syndrome.



- **C- Insertion** : A broken part of chromosome is inserted into a chromosome of another pair.

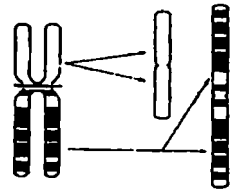
II- Deletion:

⇒ A part of chromosome is broken and lost.

⇒ Example: *deletion chr. 5* → Cri du Chat (Microcephaly, MR, CHD & Cry like cats)

III- Isochromosome:

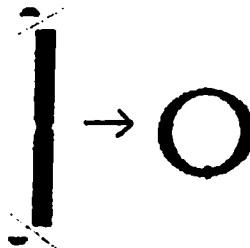
Wrong division of centromere (transverse division instead of longitudinal) resulting in two units: 2 Long arms and 2 short arms instead of 2 chromatids.



IV- Inversion:

- 2 breaks in chromosome with inversion of the intervening material and reconstitution of the chromosome.
- Inversion may be:
 - 1- Pericentric. The 2 breaks are at two opposite arms.
 - 2- Paracentric. The 2 breaks are in the same arm.

V- Ring chromosome: 2 breaks in the peripheral parts of the chromosome that stick together.

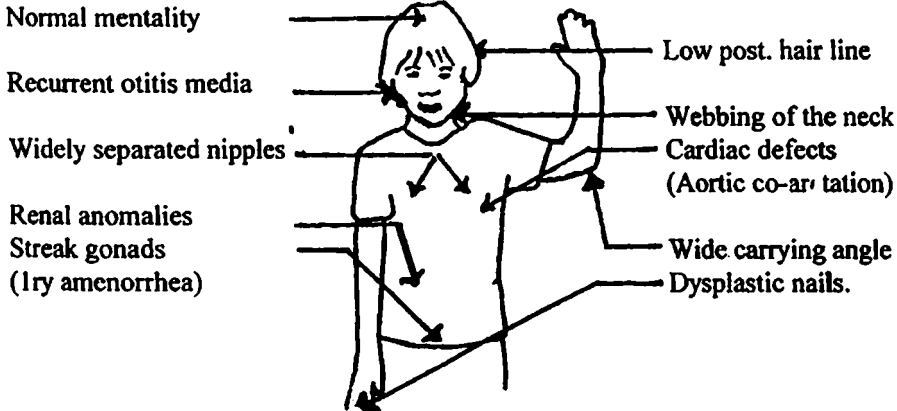


● Important Sex Chromosomal Anomalies:

❖ Turner syndrome:

- * **Causes:**
 - 1- Classic form 45, X0 (Monosomy for X-chromosome.)
 - 2- Deletion of short arm of one X chromosome.
 - 3- Turner mosaic X0/XX.
- * **Incidence:** 1/3000 (This figure is low as a lot of cases aborted before diagnosis).
- * **Manifestations:** (Phenotypically female with -ve sex chromatin).

Female with short stature and some of the following



❖ Klinefelter syndrome:

- * **Causes:**
 - 1- Trisomy of X chromosome (47 XXY) → commonest.
 - 2- More than 2 X chromosome (48 XXXY, 49 XXXXY,)
- * **Incidence:** 1/1000 of live birth males.
- * **Manifestations:** (Phenotypically male with +ve sex chromatin).
 - ⇒ Defective mentality (more retardation with ↑ number of X chromosomes).
 - ⇒ Gynecomastia.
 - ⇒ Tall stature.
 - ⇒ Atrophic testis with defective spermatogenesis.

❖ Fragile X syndrome:

- * **Causes:** Presence of fragile sites at the end of long arm of one X-chromosome (Dynamic mutation involving CGG repeats).
- * **Incidence:** 1/1000 of live birth males
- * **Manifestations:**
 - ⇒ Normal males with mental affection.
 - ⇒ Large ears, jaws and testis.
- * **Investigations :** Special culture on folate depleted medium.

☞ **N.B.:**

- ⇒ Sex chromatin is small chromatin material beside the nuclear membrane appears in persons with 2 or more X chromosomes.
- ⇒ Sex chromatin (Barr body) = $N. \text{ of } X \text{ chromosomes} - 1$. So normal male is sex chromatin -ve & normal female is sex chromatin +ve.
- ⇒ Sex chromatin is easily detected by buccal smear karyotyping.

⇒ **Important Autosomal Anomalies:**

❖ **Down syndrome (Mongolism):**

* **Definition:**

Trisomy of chromosome 21.

* **Incidence:**

The most common autosomal defect (1/700 live birth).

* **Etiology:**

- 1- **Regular Down (the commonest 95%):** Total number of chromosomes is 47 instead of 46 due to non-disjunction during meiotic division. Common in elderly mothers > 35 years (47 XY + 21). (Recurrence increase with advanced maternal age).



- 2- **Mosaic Down (1%):** Two or three cell lines are present due to non disjunction during the 1st or the 2nd mitotic division of the zygote. The patient does not show all signs of mongolism (e.g. may or may not be mentally retarded).

3-Translocation Down (3-4%): Translocation of chromosome 21 occurs on any chromosome specially 15, 22 or 14, so total number of chromosomes is 46.

This type is common in young mothers with liability for translocation.

-This translocation either occurs to D group or G group of chromosomes.

- Risk of recurrence in balanced translocation carrier is 15 % in maternal cases and 5 % in paternal cases due to prezygote selection (theoretical risk is 33 %).

Segregation pattern	Alternate	Adjacent-1	Adjacent-2		
Gametes  14 21 Balanced normal	 14q21q Balanced Robertsonian translocation	 14 Unbalanced	 14q21q Unbalanced	 14 14 Unbalanced	
Fertilization with normal gamete  14 21 Normal phenotype	 14 14q21q 21 Normal phenotype (carrier)	 14 14q21q Down syndrome	 14 Lethal	 14 14q21q 21 Lethal	 14 14 21 Lethal

-In maternal fixed translocation 21, 21 → ½ cases Down & ½ cases aborted.

* Manifestations:

1- Delayed mental milestones (MR)

2- Delayed motor milestones : with severe hypotonia (acrobat sign).

3- Delayed growth: with short stature.

4- Delayed sexual maturation: ± undescended testis in male.

5- Head:

* Size: Small, brachycephalic.

* Fontanelles: - wide delayed closure A.F.

- Opened post. F. > 0.5 cm at birth.

* Eye: - Upward slanting of palpebral fissure.

- Medial epicanthal fold.

- Hypertelorism (wide space between the medial canthi)

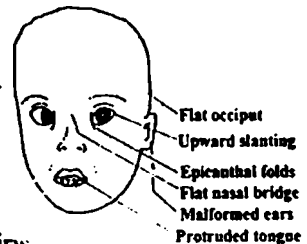
- Brushfield spots at the periphery of the iris.

* Nose: - Depressed nasal bridge.

* Ear: - Low set ears.

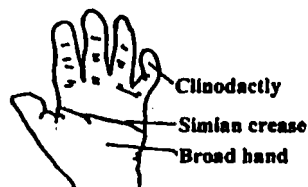
* Mouth: - Small oral cavity with protruded fissured tongue (scrotal tongue).

- Delayed teething



6- Hands:

- * Short, broad.
- * Clinodactyly (short incurved little finger due to rudimentary middle phalanx).
- * Single simian crease (Normally 2 transverse creases are found).
- * Wide atd angle (the angle between triradii at the base of the little finger, index finger and thumb which is normally acute).



7- Feet: Wide space between the big and the 2nd toe with a leading crease (ape crease) arising from it.

8- Heart: High incidence of congenital heart diseases (40% especially common A-V canal and VSD).

9- Abdomen: Distended with umbilical hernia (Due to hypotonia).

* Complications and causes of death:

Mongol is highly susceptible to:

- 1- Congenital heart diseases.
- 2- Congenital obstructive GIT disorders (e.g. duodenal atresia, Hirschsprung disease & imperforate anus).
- 3- Congenital renal anomalies.
- 4- Acute leukaemia.
- 5- Endocrinal problems (Addison, DM & hypothyroidism).
- 6- Immunodeficiency.
- 7- Recurrent skin infections.
- 8- Recurrent respiratory infections (Due to small nasal sinuses and Eustachian tube → bad drainage)
- 9- Recurrent accidental trauma (Due to M.R.)

* Diagnosis of mongolism:1- Prenatal diagnosis:

- ⇒ Low serum α fetoprotein, unconjugated estriol + elevated β HCG in maternal serum (can suspect 60-70% of cases).
- ⇒ Recently there is a more efficient screening method, with a detection rate of 95%, using maternal age and fetal nuchal translucency thickness along with maternal serum β -hCG, PAPP-A (pregnancy-associated plasma protein-A), unconjugated estriol, and α -fetoprotein.
- ⇒ Chromosomal study of cells of the foetus obtained from amniocentesis.

2- Postnatal diagnosis:

- ⇒ None of the clinical features is specific to mongolism but the association of multiple manifestations is usually diagnostic.
- ⇒ Chromosomal study in confusing cases.

3- Investigations for complications:

- ⇒ CBC and BM for leukemia.
- ⇒ ECHO for CHD.

* **Management of mongolism:**

- 1- Genetic counseling of the parents and education of them about the case and possible progression.
- 2- General health support e.g. good nutrition, vaccination, vitamin supply,
- 3- Follow up and management of complications.
- 4- Rehabilitation as any case of mental retardation. (i.e. educable/trainable/non).

❖ **Other trisomies:**

Trisomy 13,18 are not uncommon, both of them are characterized by severe mental retardation, high incidence of congenital heart diseases (more than mongolism) & most of them die in infancy.

- ⇒ **Trisomy 18 (Edward):** Micrognathia, clinched fist, rock-bottom feet, microcephaly, prominent occiput, , renal malformations (incidence 1/7000).
- ⇒ **Trisomy 13 (Patau):** Scalp defect, Cleft lip often midline, flexed fingers with polydactyly, ocular hypotelorism, cerebral malformation, especially holoprosencephaly, microphthalmia. (incidence 1/10000).

DERMATOGLYPHICS

⇒ (Derma = skin & Glyphic = curve).

- ⇒ The epidermal ridges and creases of the hand are unique for each individual even identical twins.
- ⇒ The components of dermatoglyphic pattern are:

1- **Flexion creases:**

Normally 2 transverse and 1 oblique palmar creases are present (The 2 transverse creases are fused in Mongolism).

2- **Ridge arrangement on palms:**

- ⇒ Ridges of the palm run in different directions.
- ⇒ Meeting of three ridge systems is called triradii.
- ⇒ At d angle joins the 3 triradii, normally 40° and becomes right or even obtuse in Mongolism and may be in Turner and congenital rubella syndrome.

3- **Finger patterns:**

There are three characteristic patterns over finger tips:

- ⇒ Whorl → which has two triradii.
- ⇒ Loop → which has one triradius.
- ⇒ Arch → which has no triradii.



CHAPTER (IV)

NUTRITION

NUTRITIONAL REQUIREMENTS

➤ Adequate Diet Should Supply:

- ◊ Adequate amount of calories.
- ◊ Adequate proportions of elements (50% CHO & 35% Fat & 15% proteins).
- ◊ Adequate amount of vitamins and minerals.
- ◊ Adequate amount of water.

☆ Caloric requirements:

- ① ❖ 1st month 120 Cal./kg/day (Rest of the 1st year 110 cal/k/day).
❖ 1-3 years 100 cal./kg/day
❖ After that the requirements decrease by 10 cal. every 3 years →
4-6 (90 cal/k/d) & 7-9 (80 cal/k/d). & 10-12 (70 cal /k/d) &
13-15 (60 cal/k/d) & 16-18 (50 cal/k/d). Then after 18 years old 40 cal/k/d
- ② ❖ 1 gram carbohydrates supplies 4 calories.
❖ 1 gram protein supplies 4 calories.
❖ 1 gram fat supplies 9 calories.
- ③ ❖ Carbohydrates 50% (3/6)
❖ Fats 35% (2/6)
❖ Proteins 15% (1/6) } In well balanced diet

☞ Example:

How can we calculate the daily needs of 4 years old boy?

- * Weight = $(4 \times 2) + 8 = 16$ Kg.
- * Daily caloric needs = $90 \text{ cal /kg} = 90 \times 16 = 1440 \text{ cal/day}$.
- * Division of calories on items:

⇒ CHO	$= 1440 \times 3/6 = 720 \text{ cal.}$	→ $720/4$	$= 180 \text{ grams/ day.}$
⇒ Fat	$= 1440 \times 2/6 = 480 \text{ cal.}$	→ $480/9$	$= 53 \text{ grams/day}$
⇒ Proteins	$= 1440 \times 1/6 = 240 \text{ cal.}$	→ $240/4$	$= 60 \text{ grams/day.}$

☆ Water requirements:

Amount:	Age (years)		water req. (ml/kg/day)
	Below 1 year	⇒	150
	1-3 years	⇒	125
	4-6 years	⇒	100
	7-12 years	⇒	75
	13-18 years	⇒	50

☼ Sources of water:

Daily water intake = Fluids + 12 ml water from every 100 calories metabolised.

☆ Protein Requirements:

★ Types of amino-acids:

① Essential A.A.

(Necessary for growth and development and can not be synthesized by the body)

⇒ Valine, Isoleucine, Threonine, Arginine, Leucine.

⇒ Lysine, tryptophan, Methionine, Phenylalanine, Histidine.

+ Tyrosine & Cystine in children only.

② Non-essential A.A.:

(Can be synthesized by the body but should be adequately supplied as their deficiency will result in consumption of essential A.A. for their production.)

★ Amount of required proteins:

⇒ up to one year → 2.5 gm/kg/day.

⇒ 1-5 years → 2 gm/kg/day.

⇒ 6-10 years → 1.5 gm/kg/day.

⇒ 11 years and more → 1 gm/kg/day.

- Children need more protein than adults, because they are more rapidly growing and also are more susceptible to deficiency as they are more liable for G.E. (Ptn. loss)

☆ Fat Requirements

★ Types of fatty acids:

⊗ Saturated F.A.

⊗ Unsaturated F.A.

◇ Essential fatty acids are long chain polyunsaturated fatty acids (LCPUFA) e.g. linoleic, linolenic and arachidonic acid. They are important for growth, hair & skin integrity, synthesis of prostaglandins, CNS and retinal development.

★ Functions of Fat:

- ⇒ Support body structure ⇒ Temperature preservation.
- ⇒ Food stores ⇒ Help absorption of fat soluble Vitamins.

☆ Carbohydrate Requirements:

★ Types of CHO:

◇ Polysaccharides e.g. starch, cellulose.

◇ Disaccharides e.g. maltose, sucrose, lactose.

◇ Monosaccharides e.g. glucose, fructose, galactose.

★ Daily needs of CHO: About 10 grams / Kg/day.

★ CHO metabolism:

1. Polysaccharides $\xrightarrow[\text{Pancreatic amylase}]{\text{Salivary and}}$ Disaccharides.

2. In intestinal wall →

* Lactose	$\xrightarrow{\text{lactase}}$	galactose	+ glucose.
* Maltose	$\xrightarrow{\text{Maltase}}$	glucose	+ glucose.
* Sucrose	$\xrightarrow{\text{Invertase}}$	fructose + glucose.	

- Fructose absorption is a passive process while absorption of glucose and galactose are active processes.

ABNORMAL NUTRITION

* Abnormal nutrition may present as:

1. Undernutrition : Chronic caloric deficiency. e.g. Marasmus
2. Overnutrition : Caloric excess e.g. obesity.
3. Malnutrition : Deficiency of one or more elements with normal or even increase total caloric intake e.g. protein deficiency, vitamin deficiency.

PROTEIN ENERGY MALNUTRITION (PEM)

- Syndromes resulting from caloric and/or protein deficiency, they include:
(Kwo , incomplete Kwo - marasmus – marasmic Kwo – nutritional oedema – nutritional dwarfism).

* Classifications:

1. Gomez classification:

- | | | |
|---|---|----------------------------------|
| <ul style="list-style-type: none"> • 1st degree → weight is 75 - 90%. • 2nd degree → weight is 60-75%. • 3rd degree → weight is below 60%. | } | of expected body weight for age. |
|---|---|----------------------------------|

2. Jelliffe classification:

- | | | |
|---|---|---------------------------------|
| <ul style="list-style-type: none"> • 1st degree → weight is 80 - 90%. • 2nd degree → weight is 70-80%. • 3rd degree → weight is 60-70%. • 4th degree → weight is below 60%. | } | of expected body weight for age |
|---|---|---------------------------------|

3. Wellcome classification: Depending on weight and presence of oedema.

Body weight	Oedema	Diagnosis
> 80 %	++	Nutritional oedema (or) Kwo.
60-80 %	----	Simple under weight
60-80 %	++	Kwo
< 60 %	---	Marasmus
< 60 %	++	Marasmic Kwo

4- Water Low classification

- ◇ Wasted ⇒ weight / length < 80 %
- ◇ Stunted ⇒ length / age < 90%
- ◇ Both ⇒ if both above items are present.

KWASHIORKOR (oedematous PEM)

* Definition:

- ◊ Acute state of malnutrition characterised by protein deficiency with normal or even increase caloric intake.
- ◊ The term "kwashiorkor" comes from Ghana and means red baby, It also refers to the illness of the older child when the next baby is born.

* Aetiology:

① Dietary causes:

- ⇒ **Negligence:** when the 2nd child is born, he takes the breast milk while the 1st one is given low milky, high starchy diet resulting in increase total calories in the form of CHO with low proteins.
- ⇒ **Ignorance:** Faulty weaning either by sudden weaning on low protein diet or substitution of milk by high CHO starchy diet.

② Non dietary causes:

⇒ Infection:

A lot of infections can lead to kwashiorkor due to accompanying anorexia and faulty food restriction, some infections are especially important:

- Prolonged diarrhea due to → loss of protein in stool.
- Measles due to → complicating enterocolitis.
- Whooping cough due to → recurrent vomiting.

⇒ Parasitic infestations:

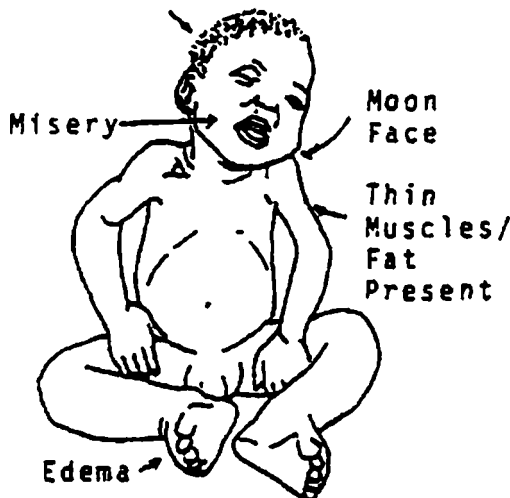
e.g. ankylostoma, giradia lamblia,

☞ **N.B:** Non dietary causes only precipitate KWO in marginally malnourished child.

* Clinical Manifestations:

(Age → 85% from 6 months to 3 years)

Hair
Changes



❶ Constant features: (should be present in all cases of Kwo)

* **Mental changes:**

- ⇒ **Chch** → Lethargy, apathy, loss of interest.
 ⇒ **Causes** → ↓ serotonin level.
 ↓ nicotinic acid level.
 ↓ aromatic amino acids (serotonin, phenyl alanine).
 maternal deprivation.

*** Growth retardation:**

- ⇒ **Chch** →
- Delayed milestones.
 - Length is less affected than weight but weight loss may be masked by oedema.
- ⇒ **Causes** → Protein deficiency.

* **Muscle wasting:**

- ⇒ **Chch** → • Weak, thin atrophic muscles with ↓ MAC.
• S.C. fat is preserved, so muscle /fat ratio is low
- ⇒ **Causes** → Protein deficiency.

* Oedema:

- ⇒ **Chch** →
- Usually starts in the dorsum of hands and feet.
Gradually involves arms, thighs, genitalia, back and face.
 - pleural effusion and ascitis are almost unknown but Kwo may be a predisposing factor for other agents to produce them (e.g. T.B., septic peritonitis & severe pneumonia)
- ⇒ **Causes** →
- Hypoalbuminaemia.
 - Salt and water retention (increased production and decreased inactivation of aldosterone & ADH by the liver)
 - Weak capillary support → ↑ capillary permeability.
 - Imbalance between oxidants and antioxidants

② Variable features: (May be present or absent)

*** Hair changes:**

- ⇒ **Chch** →
- Hair loses its lustre and becomes straight, fine and easily detachable.
 - Its colour becomes pale reddish, even grey or white in severe cases.
 - Flag sign may be present in long haired children with long duration of illness (Darker zones of good nutrition and pale zones in disease relapse times)
- 
- ⇒ **Causes** →
- ↓ sulphur containing amino acids.
 - ↓ tyrosine which is needed for melanin pigment synthesis.



* **Skin changes:**

- ⇒ **Chch** →
- Darkness and hyperpigmentation which may be followed by desquamation and depigmentation.
 - Found mainly in irritated areas (perineum, inguinal, back of the thigh, buttocks) not in sun exposed areas as pellagra.
 - Called (Flaking paint dermatosis, cobble stone or crazy pavement appearance)
- ⇒ **Causes** →
- ↓ Nicotinic acid.
 - ↓ Essential fatty acids, vitamin A and zinc.
 - ↓ Adrenocortical function.

* **Hepatomegally:**

- ⇒ **Chch** →
- Palpable liver is common due to fatty infiltration.
 - Enlargement may increase at the onset of therapy due to accumulation of glycogen before getting rid of fat, then regression of size occurs with more improvement. This hepatomegally with ttt is called "Nutritional recovery syndrome".
 - Fatty infiltration in Kwo is reversible and never leads to cirrhosis (as Kwo is acute illness, baby either die or recovered completely).
- ⇒ **Causes** → Fatty infiltration may result from:
- ↓ Lipotropic factors
 - ↑ Fat mobilization from adipose tissue

* **GIT troubles:**

- ⇒ **Chch** → Anorexia, vomiting, diarrhea or steatorrhea.
- ⇒ **Causes** →
- Atrophy or oedema of intestinal mucosa.
 - Enzymatic deficiency.
 - Repeated infections.

* **Anaemia:**

- ⇒ **Chch** →
- | | | |
|------------------------|--------------|--------------------------------|
| • Microcytic | • Normocytic | • Macrocytic |
| ⇒ Causes → ↓ Fe | ↓ Protein | ↓ Folic acid & B ₁₂ |

* **Vitamin deficiency:** see later

◆ **Pathology:**

- ◆ **Liver:** Fatty infiltration & may be necrosis and fibrosis (but no cirrhosis).
- ◆ **Pancrease:** Atrophy of the acini with decrease zymogen granules → ↓ enzymes.
- ◆ **Muscles:** Decrease cell size and decrease intercellular protein and electrolytes.
- ◆ **Subcutaneous fat:** Normal or even increased.
- ◆ **Skin:** Hyperkeratosis and pigmentary changes.

* **Complications:** (H4 - ABCDEF)

- 1) **Hypoglycaemia** (due to enzymatic deficiency, liver affection, decreased l-carnitine and muscle alanine).
- 2) **Hypothermia** ($\uparrow$ lost due to oedema, $\downarrow$ production if associated caloric deficiency)
- 3) **Hypomagnesaemia** $\rightarrow$ tetany.
- 4) **Hypokalaemia** $\rightarrow$ usually present from the start, $\uparrow$ by I.V. fluids and ttt of acidosis
- 5) **Anaemic heart failure.**
- 6) **Bleeding** due to hypoprothrombinaemia, $\uparrow$ capillary fragility or DIC.
- 7) **Corneal ulceration:** Due to vitamin A deficiency $\rightarrow$ may lead to blindness (as keratomalacia is usually non-reversible).
- 8) **Diarrhea:** Due to lactase deficiency or infection.
- 9) **Electrolytes disturbance and dehydration.**
- 10) **Frequent infections:** Skin, GIT, Respiratory, Oral moniliasis and T.B.

* **Differential diagnosis:**

- * Other causes of oedema (Cardiac, Renal, Hepatic & Angioneurotic)
- * Other causes of skin lesions (Pellagra, Addison disease & Napkin dermatitis).
- * Other causes of PEM especially marasmus.

* **Investigations:**

A- Biochemical Changes:

① **Plasma Proteins:**

- * Low albumin level < 2.5 gm% (2.5-2.7% in subclinical KWO).
- * Low serum enzymes (Amylase, Lipase,).
- * Gamma globulins may be elevated (due to infection).
- * Amino acid level may be normal or even elevated but $\uparrow\uparrow$ the ratio of non essential A.A./essential A.A. is diagnostic (normally 2, 2-3 in subclinical Kwo & ≥ 3 in Kwo).

② **Serum Lipids:**

- * $\downarrow$ cholesterol which returns to normal soon after ttt.
- * $\uparrow$ free fatty acids (due to $\uparrow$ CHO diet).

③ **Blood Glucose:**

- * Hypoglycaemia is a common complication.

④ **Serum Minerals, Vitamins and Electrolytes:**

- * $\downarrow$ level of copper, zinc, Mg, Iron, K, Vit. B12 & folic acid.
- * $\uparrow$ sodium but water increases much which leads to dilutional hyponatraemia.

⑤ **Urinary Findings:**

- * $\downarrow$ urinary urea, and hydroxy proline.
- * $\downarrow$ urinary 17(OH) steroids due to failure of adrenocortical function.

B- Routine investigations:

- 1- CBC : to detect anemia and leucocytosis.
- 2- ABG and electrolytes
- 3- Urine and stool analysis
- 4- Blood glucose serially
- 5- Sepsis work-up.

*** Prognosis:**

- * The younger the age, the worse the prognosis.
- * Mortality of KWO = 15-30%.

*** Management: of PEM, see later.**

MARASMUS (non oedematous PEM)

* **Definition:**

- * Chronic state of undernutrition characterized by progressive weight loss.
- * It is better called syndrome rather than disease.

* **Aetiology:** (= causes of failure to thrive)

I- **Dietetic Causes** (Primary)

Quantitative Causes

- ◆ Scanty milk supply in breast fed infants.
- ◆ Insufficient milk amount in artificially fed infants.
- ◆ Insufficient calories in diet of older children.

Qualitative Causes

- ◆ Prolonged breast feeding without supplementation.
- ◆ Diluted formulae in artificially fed infants.
- ◆ Reliance on fluid only in diet of older children.

II- **Non-dietetic causes** (secondary)

1- **GIT Causes:**

◆ **Failure to assimilate food:**

- ◇ Inadequate digestion: e.g. cystic fibrosis of the pancrease.
- ◇ Inadequate absorption: e.g. malabsorption syndrome.

◆ **Loss of food:**

- ◇ Prolonged or recurrent gastroenteritis.

- 2- **CNS disorders:**
- Degenerative brain diseases
 - Cerebral insults (Hge, thrombosis, infection,)

- 3- **Infections:** Marasmus may be a complication of acute or chronic disease as: T.B. congenital, chronic otitis media, bronchiectasis,

Due to →: • Anorexia • Food intolerance • ↑ body catabolism.

- 4- **Infestations:** esp. *Giardia lamblia*.

- 5- **Prematurity:** Premature is more susceptible for marasmus than normal as premature has:
- Low fat stores
 - Weak suckling power
 - Limited capacity for digestion and absorption.

6- **Congenital anomalies:**

- Defective cerebral development.
- Congenital heart diseases.
- Congenital obstructive GIT diseases
- Developmental renal anomalies with superadded recurrent UTI.

7- **Metabolic disorders:**

- Lactose intolerance
- Galactosaemia
- Phenylketonuria.
- Glycogen storage diseases
- Lipoid storage diseases.

8- **Endocrinal:**

- Hyperthyroidism
- DM
- Hypoadosteronism "Addison"

9- Malignant tumours of infancy:

- Leukaemia
- Wilm's tumour
- Neuroblastoma

10- Intoxication:

- Chronic lead poisoning
- Chronic drug exposure (e.g. anticonvulsants)

11- Psychological problems:

The most important is maternal deprivation syndrome.

◆ Clinical manifestations:

◆ **Age** 1-1.5 years and may be older in 2ry marasmus.

◆ Symptoms:

- Failure to thrive.
- Symptoms of the cause.
- Symptoms of complications.
- Hunger: → Irritability, Crying, finger suckling.
→ Constipation or starvation diarrhoea (semisolid, dark green, infrequent, with mucus and debris).

◆ Signs:**1- Caloric deficiency manifestations: (constant)****⇒ Loss of subcutaneous fat:**

- 1st degree: Loss of abdominal wall S.C. fat.
- 2nd degree: Loss of buttocks and thigh S.C. fat.
- 3rd degree: Loss of face and buccal pad S.C. fat (**senile or oldman appearance**).
(Buccal fat is the last fat sacrificed by the body being unsaturated and essential for good suckling).

⇒ Hypothermia:

Due to loss of the insulatory effect of S.C. fat, ↓ energy production & BMR.

2- Protein deficiency manifestations: (constant)**⇒ Failure to gain weight:**

- 40% wt. loss → 1st degree
- 40-50% wt. loss → 2nd degree
- > 50% wt. loss → 3rd degree.

⇒ **Muscle wasting** sacrificed to retain normal plasma proteins.

3- Skin manifestations: (constant)

- Loose, thin, wrinkled.
- Inelastic (to be D.D. from dehydration)
- Thrown into folds especially medial side of the thigh.

4- Vitamin deficiency: → The same as kw.**5- Anaemia: → The same as kw.****6- General:**

- Pulse: Weak
- BP: ↓↓
- Temp: ↓↓.

☞ **N.B.** • Rickets is rare and if present is called (Atrophic rickets) which is chch by delayed teething / wide AF / hypotonia without other rachitic manifestations
• Normal costochondral junctions appear prominent what is called (false rosaries).

* Pathology:

- BMR = The calories needed to maintain life at complete physical and mental rest (necessary for life).
- In infants the daily caloric intake is consumed as follows:

BMR	50 %	⇒ unavoidable
Physical activity	25 %	
Growth	12.5 %	
Loss and others	12.5 %	⇒ unavoidable
- When there is caloric deficiency the first compensatory mechanism will be decrease physical activity and arrested growth. With advanced caloric deficiency the body utilizes his own tissues firstly fat then proteins to maintain BMR which results in marasmus.

* Complications:

- As KWO +
- Atrophic ulcers over bony prominences.
 - Muscle fibrosis in advanced cases.
 - Oedema (marasmic Kwo).
- *N.B.:* Hypothermia is a part from C/P in marasmus (not a complication as Kwo)

* Differential Diagnosis:

- 1- DD of the cause. (1ry. or 2ry)
- 2- DD from other causes of PCM esp. KWO.
 - KWO is characterized by oedema & mental changes
 - Marasmus is characterized by wt. loss & S.C. fat loss.

* Investigations:

Marasmus is a clinical syndrome, so investigations are not needed for diagnosis but important in finding the underlying cause in 2ry marasmus.

- ① Urine:
 - * Analysis for U T I.
 - * Ketonuria (due to fat consumption)
- ② Stool:
 - * Parasitic infestations
 - * Stool PH ($\downarrow$ PH $\approx$ lactase deficiency)
- ③ Blood:
 - * Sepsis screen.
 - * Metabolic screen.
 - * Endocrinal functions
- ④ Radiology:
 - * Chest X-ray for chest problems
 - * Barium meal for pyloric stenosis
 - * Sonar abdomen for malignancy
 - * ECHO: for cardiac defects

* Prognosis:

- Bad prognosis with advanced degree of wasting and younger age of cases
- Prognosis of the underlying cause affect the prognosis of marasmus.

OTHER FORMS OF PEM**1 Incomplete KWO:**

- The infant shows to a lesser degree all constant features except oedema & and some variable features except skin changes, common in convalescent from GE, if not treated → KWO.

2 Marasmic kwashiorkor:

- ◊ Protein deficiency on top of caloric deficiency (e.g. marasmic child treated with low protein diet.) or caloric deficiency on top of kwashiorkor.
- ◊ Indicated with ⇒ Appearance of oedema in marasmus.
 ⇒ Loss of subcutaneous fat in kwashiorkor.

3 Nutritional Dwarfism:

- 1- The main clinical feature is small sized infant.
- 2- Osseous maturation is slightly delayed.
- 3- Muscles and S.C. fat are proportionate to body size.
- 4- Serum proteins and other laboratory data are normal.

4 Simple under weight:

- ❶ Failure of growth indicated by low body weight or inadequate weight gain.
- ❷ Flat buttocks, small chest in relation to head and abdomen.

5 Malnutrition in older children:

- The same causes of failure to thrive may result in malnutrition if occurs in childhood, however the causes will be mainly dietary and manifestations are mainly failure to gain weight, pallor, easily fatigability, school underachievement. It is not called PEM after 3-4 year.

MANAGEMENT OF PEM

➤ Prevention of PEM:

I- At the individual and family level:

- Regular recording of the body weight for picking up children who are not gaining weight adequately (flat curve is an early indicator of PEM)
- Promotion and prolongation of breast feeding.
- Educating mother for food supplementation from age of 4 months with Fe, vit D,...
- Usage of cup and spoon is better than bottle in artificially fed infants as contaminated bottles leading to recurrent G.E. is the rule.
- Vaccination against measles, pertussis, and T.B.

II- At the national and public health level:

- Improving standard of living and food supply.
- Introduction of pure water supply and sewage disposable system for prevention of G.E. (The major cause of PCM.)
- Health education through mass media e.g. Television.

➤ Treatment of PEM

❶ **Hospitalization:** especially with severe cases.

❷ **Urgent management of life threatening conditions:**

- Fluid therapy for dehydration.
- In severe anemia or shock blood transfusion (20 ml/kg in marasmus & 10 ml/kg in KWO) or packed RBC'S transfusion (half of the previous amounts)
- Management of hypothermia.
- Correction of metabolic and electrolyte disturbances.
- Management of infection (e.g. antibiotics).

❸ **Treatment of the cause if curable.**

❹ **Supportive measures:**

- Multivitamin supply especially (both water and fat soluble vitamins).
- Mineral supply: Mg., Zinc, K,.... (iron is better delayed to final stage of ttt as it may lead to oxidant damage of the tissues & ↑ susceptibility to infection).
- Plasma or Albumin may be indicated to raise plasma protein level in KWO.

❺ **Dietetic management (Start low and go slow):**

Amount: three phases are considered:

- * 1st stage (1-2 days): only fluids to correct dehydration ± small feeds.
- * 2nd stage (2-10 days): 80-100 cal./ kg/d (no more).
- * 3rd stage (after stabilization): 150-220 cal./ kg/d .

Types:**a) Milk:**

- In breast fed give breast milk and supplementary feeds.
- In artificially fed Acidified, skimmed and lactose free are ideal early as they are easily digested, if digestion remains satisfactory with no vomiting nor diarrhoea fat and lactose content should be increased gradually.
- In persistent diarrhea with stool PH < 6 lactose free milk is used.

b) Simple prepared milk feeds: e.g.

- Pudding
- Yoghorth with sugar or honey, Powdered milk + oil + sugar.

c) Other feeds: (According to age)

- F75 is used initially , F100 is used later as it contains higher protein.
- High caloric supply: Rice, potatoes, soup,....
- High protein supply: Meat, chicken, egg, fish, liver,...

starter and catch-up formula

	Starter formula (F-75a)	Starter formula with cereal (F-75b)	Catch up formula F-100 ⁺⁺
Dried skimmed milk (g)	25	25	80
Sugar (g)	100	70	50
Cereal flour (g)	-	35	-
Vegetable oil (g)	27	27	60
Electrolyte-mineral solution (ml)	20	20	20
Water:	1000	1000	1000
use to make up final solution to (ml)			

⑥ Criteria of Recovery:

- ◊ Improve appetite.
- ◊ Decrease oedema, normal serum albumin.
& initial ↑ in liver size followed by regression in KWO.
- ◊ Initial weight loss followed by weight gain in marasmus.

Problems may occur during ttt of KWO:

- 1- Hypokalaemia (with ↑ IV glucose).
- 2- Hypervolaemia (esp. with over transfusion of blood or plasma).
- 3- ↑ protein load on the diseased liver:
→ ↑ ammonia (hepatic encephalopathy)
→ LCF

N.B. Refeeding syndrome may complicate the acute nutritional rehabilitation of children who are undernourished from any cause. The hallmark of refeeding syndrome is the development of severe hypophosphatemia after the cellular uptake of phosphate during the 1st week of starting to refeed. Serum phosphate levels of ≤ 0.5 mmol/L can produce weakness, rhabdomyolysis, neutrophil dysfunction, cardiorespiratory failure, arrhythmias, seizures, altered level of consciousness, or sudden death.

FAILURE TO THRIVE (FTT)

* Definition

- Physical growth of an infant or child less than his peers, usually associated with poor developmental functioning.
- FTT usually refers to growth below the 3rd or 5th percentile for age & sex as regards to both height and weight.

* Aetiology: The same causes of marasmus (dietary & organic).

* How to approach the diagnosis:

• History:

- ↳ Abnormal dietetic history.
- ↳ History suggesting organic lesion.

• Exam.:

- ↳ To prove failure to thrive (repeated weight, length, head circumference and mid arm circumference recording and plotted in charts).
- ↳ For the cause.

• Investigations:

- ↳ For the cause.

* Treatment:

- Nutritional support.
- Treatment of the cause.

Obesity

* Definition:

- Body weight above the 97th centile for age & sex.
- Body mass index (BMI) > 30 "BMI = weight / (height in meters)²"

* Causes:

(I) Exogenous (simple) obesity

- Majority of cases
- Usually not associated with MR, short stature or other features.
- Causes:
 - 1- Excessive eating & diminished activity.
 - 2- Psychological factors.
 - 3- Family history of obesity may present.

(II) Endogenous (organic) obesity

- Minority of cases
- Commonly associated with MR, short stature or other anomalies.
- Causes:
 - 1- Endocrinal causes:
 - ↳ Hypothalamic syndrome.
 - ↳ Hypothyroidism.
 - ↳ Pseudo hypoparathyroidism.
 - ↳ Cushing syndrome (↑ corticosteroids either endogenous or iatrogenic).
 - ↳ Stein Leventhal syndrome (female with polycystic ovary).

2- Genetic causes:

- ↳ Leptin resistance (a hormone acting on hypothalamus to suppress food intake), genetically predisposed patients to leptin resistance will be obese.
- ↳ Many genes are encountered in the development of obesity.

3- Inherited disorders:

- ↳ Laurence Moon-Biedle syndrome: MR, short stature, retinitis pigmentosa.
- ↳ Prader – Willi syndrome: MR, hypotonia, hypogonadism ± DM.
- ↳ Beckwith-Wiedeman syndrome: Macrosomia, macroglossia, hypoglycaemia.

*** Complications of obesity:**

- 1- **Metabolic:** NIDDM, gall stones.
- 2- **Respiratory:** Dyspnea, respiratory distress.
- 3- **CVS:** Hypertension, ischaemia.
- 4- **Orthopedic:** Osteoarthritis, back pain.
- 5- **Psychological:** depression

*** Diagnosis of obesity:**

- ↳ History, Exam. & Investigations to detect endogenous obesity

Assessment of nutritional status**☆ History:**

- Dietetic history
- Exposure to sun light
- Developmental history
- Vitamin and mineral supplementations
- Infections especially recurrent gastroenteritis

☆ Examination:

- Anthropometric measurements and should be plotted against growth curves.
- Signs of PEM e.g. nutritional edema, lost Sc fat,
- Signs of vitamin and mineral deficiencies e.g. pallor, ricketic manifestations, angular cheilitis,

☆ Investigations:

- CBC -Serum albumin, Serum prealbumin, retinol binding protein and transferrin
- Blood glucose, Serum electrolytes -Alkaline phosphatase, x-ray wrist and ankle.

MINERALS REQUIREMENTS

	Calcium	Iron	Magnesium	Phosphorus
* Sources	- Milk, cheese - green vegetables	- Liver, meat - Vegetables, apple	- Milk, meat - cereals, legumes	- Milk, milk Products, meat
* Functions	- Bone & teeth - Muscle contraction - Nerve transmission - Blood coagulation - Cardiac action	- Haemoglobin. - Myoglobin. - Oxidative enzymes as catalase & cytochrome oxidase	- Bone & teeth - Conversion of proparathormone to parathormone	- Bone & teeth - Structure of muscles - CHO and fat metabolism
* Deficiency	- Rickets - Tetany - Delayed teething	- Iron deficiency anaemia	- Tetany	- Rickets

VITAMIN REQUIREMENTS**Water soluble vitamins****Fat soluble vitamins**

- ♦ B complex and C
- ♦ Not stored in the body so not usually toxic

- ♦ ADEK
- ♦ Stored in the body so may be toxic.

WATER SOLUBLE VITAMINS

	B1 "Thiamine"	B2 "Riboflavin"	Nicotinic acid	B6 "Pyridoxine"	Vitamin C "Ascorbic acid"
Sources:	- Meat, fish, egg, milk. - Legumes & nuts	- As B1	As B1, also, endogenous synthesis from tryptophan	- Meat, liver, kidney - Grains, Peanuts, Soyabeans	- Citrus fruits - Green vegetables - Tomatoes
Pathogenesis of vitamin deficiency:	"BeriBeri" - Infants who are breast fed to B1 deficient mothers. - Older child with ↓ B1 containing food	"Ariboflavinosis" - Deficiency of Riboflavin alone is rare, always accompanied with other vit. deficiency or KWO	"Pellagra" - <u>Diet</u> esp. In corn dependent which is deficient in tryptophan - <u>Drugs</u> esp. INH which antagonize niacine metabolism. - <u>Hartnup Disease</u> : A.A. transport defect associated with ataxia	- <u>1ry</u> deficiency is rare as most foods contain B6 - <u>2ry</u> deficiency due to drugs (INH, hydralazine) or malabsorption is common	"Scurvy" - Animal milk is ↓↓ in vit. C., destroyed by boiling - Breast milk vit. C is variable according to mother intake.
Manifesta- tions of the disease	1- <u>Cardiac</u> Cardiomyopathy & H.F. 2- <u>Neurological</u> - Sensory neurop- athy & foot drop - Wernicke Kors- akoff syndrome. Psychosis, ataxia, confusion. 3- <u>Aphonic</u> hoarseness and aphonia due to laryngeal involvement	"Oro-oculo- genital" <u>Skin</u> seborrheic dermatitis <u>Mouth</u> Angular stomatitis, glossitis & cheilosis <u>Eye</u> Conjunctivitis	- <u>Diarrhea</u> (GIT troubles-red swollen tongue) - <u>Dermatitis</u> Sites exposed to sunlight and trauma. Chch by erythema and pigmentation - <u>Dementia</u> CNS involvement	- B6 is essential for GABA formation "Neurotransmitter" so B6 ↓ = GABA ↓ = convulsions and neuropathy - Anaemia (microcytic) esp. in adults.	- Swollen, bleeding gums. - Angular deformities of sternocostal junctions "Scurptic rosaries" - Poor wound healing - Pseudo paralysis due to tender bones (Sub- periosteal hge)

FAT SOLUBLE VITAMINS

Vitamin A

* **Daily requirements:** 1500 I.U./day

* **Sources:**

- Retinal: "Animal sources" → liver, meat, fish, egg, milk.
- Carotene(Provitamin): "Plant sources" → Dark green vegetables & carrots.

* **Functions:**

- ① Formation of rhodopsin which is responsible for dark vision.
- ② Integrity of tissues and skin.

* **Deficiency:**

• **Pathogenesis:**

- ⇒ Decrease intake and PEM.
- ⇒ Malabsorption.

♦ **Clinical features:**

- ① **Eye:** → Night blindness (can't be documented in infancy)
 → Xerosis (In conjunctiva, later in cornea)
 → Bitot spots (in the interpalpebral fissure near the limbus)
 → Keratomalacia (corneal ulceration and permanent damage).
- ② **Skin:** Follicular hyperkeratosis, mainly at thighs and back of upper arms (Not specific to vit. A)

♦ **Treatment:**

- Prophylactic oral dose 200.000 IU/6 months.
- In mild symptoms daily oral dose 30.000 IU.
- In severely ill with vomiting → vit. A palmitate I.M.

* **Overdose (Toxicity):**

✦ **Acute hypervitaminosis A:**

- Due to ingestion of single large dose.
- Manifested as ↑ ICT (vomiting, headache, restlessness)
- Spontaneous recovery usually occurs.

✦ **Chronic hypervitaminosis A:**

- Due to continuous daily intake of large doses.
- Early sparse hair, dry skin, cracked lips, craniotabes.
- Later on: Osteoporosis, deformities of the metaphysis, premature epiphyseal closure → stunting.

Vitamin E "Tocopherol"

- ✱ **Daily requirements:** 15-25 IU/day.
- ✱ **Sources:**
 - Infant needs are sufficient in breast milk.
 - Nuts, legumes & green vegetables.
- ✱ **Functions:**
 - Antioxidant
 - Cell membrane stabilizer
- ✱ **Deficiency:**
 - **Pathogenesis:**
 - Premature and PEM
 - Malabsorption.
 - **Manifestations:**
 - Hemolytic anaemia, oedema and thrombocytosis exaggerated by high doses of Iron.
 - CNS manifestations in severe vit. E deficiency (e.g. Ataxia, weakness & loss of deep tendon reflexes).
 - **TTT:** • Tocopherol acetate IM for prematures with ↓ polyunsaturated F.A. in diet.
- ✱ **Hypervitaminosis E:**
Large doses of vit. E may predispose to NEC & liver necrosis.

Vitamin K

- ✱ **Daily requirements:** May be nothing, as intestinal flora can synthesize it, bile salts is essential for vit. K absorption.
- ✱ **Sources:**
 - Nuts, leafy vegetables (breast milk is deficient in vit. K).
- ✱ **Functions:**
 - Important for clotting factors synthesis (II, VII, IX, X).
- ✱ **Deficiency:**
 - **Pathogenesis:**
 - ↓ Bacteria flora e.g. newborn or broad spectrum antibiotics.
 - Malabsorption
 - **Manifestations:** • Bleeding (In neonates → Hgic disease of the newborn)
 - **Prophylactic:**
 - 1-10 mg. vit. K (natural) I.M. for all babies immediately after delivery (N.B. → synthetic vit. K competes with bilirubin for plasma protein binding sites → jaundice)
- ✱ **Hypervitaminosis K:**
Large doses of synthetic vit. K may lead to hemolysis especially in children suffering from G6PD deficiency.

Vitamin D

- ✱ **Daily requirements:**
 - Normal infant: 400 IU from the 4th month.
 - Premature infant: 1000 IU from the 1st-2nd month.

- ✱ **Sources:**

- Rich: Fish, liver oil, egg yolk, cheese & butter.
- Poor: Breast and cow's milk, vegetables and cereals.

- ✱ **Metabolism:**

- ⇒ Vit. D has 2 forms: D2 of plant origin and D3 of animal origin.
- ⇒ Vit. D is absorbed from upper intestine with triglyceride solution in presence of bile.
- ⇒ Vit. D is present in human skin in inactive forms:
 - "7-dehydrocholesterol" activated by UVR in sunlight → D3.
 - "ergosterol" activated by UVR in sunlight → D2.
- ⇒ In the liver vit. D is converted to 25 (OH) cholecalciferol catalysed by 25 hydroxylase enzyme.
- ⇒ In the kidney further hydroxylation occurs at carbon atom number 1 catalysed by $\alpha 1$ hydroxylase enz. ⇒ 1.25 Di(OH) cholecalciferol which has strong hormonal action (if serum calcium is high hydroxylation occurs at carbon atom 24 → 24, 25 Di(OH) CCF → low activity).

- ✱ **Functions:** 1.25 Di(OH) cholecalciferol is the most active form of vit. D, essential for:

- ↑ Ca & Ph absorption from the intestine by stimulating synthesis of Ca transport protein.
- ↑ Ca & Ph reabsorption from the renal tubules.
- ↑ Deposition of Ca and phosphorus in bone (occasionally ↑ Ca resorption from bone).

- ✱ **Toxicity** (Hypervitaminosis D):

- **Aetiology:**
 - 1- Most commonly iatrogenic (↑ Vit. D intake)
 - 2- May by idiosyncrasy to vit. D.
- **C/P:**
 - Manifestations occurs 1-3 months after large intakes with picture simulating hypercalcaemia:
 - ⇒ Nausea, vomiting and constipation.
 - ⇒ Polyuria, polydipsia and dehydration.
 - ⇒ Hypotonia, hyporeflexia.
 - In advanced cases there will be deposition of calcium in various organs
 - ⇒ Nephrocalcinosis, aortic stenosis and soft tissue calcification.
- **X-ray** shows calcification of the involved site.
- **D.D.:**
 - 1- From other causes of hypercalcaemia.
 - 2- From other causes of polyuria and polydipsia.
- **Treatment:**
 - 1- Stop Vit. D and Ca intake.
 - 2- Correct dehydration (Ca dilution and ↑ urinary Ca excretion).
 - 3- In severe cases corticosteroids can be used (decrease Ca absorption from GIT by blocking the action of 1, 25 Di(OH) CCF on GIT).

TETANY

• **Definition:** A state of neuromuscular irritability

• **Causes:**

① **Hypocalcaemia:** (serum calcium below normal)

- ♦ Vitamin D deficiency (Infantile Tetany)
- ♦ Other causes :
 - Hypoparathyroidism - ↓ Ca intake - ↑ Ca loss - ↓ Ca absorption

② **Alkalosis:** (Decrease ionization of calcium)

- ♦ Hyperventilation (Hysterical, high altitude, encephalitis)
- ♦ Excess alkali intake (e.g. sodium bicarbonate).
- ♦ Loss of HCl (e.g. repeated vomiting).

③ **Hypomagnesaemia:** (serum Mg below normal)

Causes syndrome simulating tetany with no cramps.

• **Clinical picture:**

① **Latent tetany:** (Border line Ca level i.e. Ca = 7-9 mg/dl)

- ♦ Chvostek's sign: Tapping on the facial N. (front of the ear) → facial muscles contraction.
- ♦ Peroneal sign: Tapping on the peroneal N. (Neck of fibula) → dorsiflexion and abduction of the foot.
- ♦ Trousseau's sign: Inflate blood pressure cuff > systole for 2-5 minutes → carpal spasm.
- ♦ Erb's sign: Galvanic current < 4 milliamperes → contraction of the involved muscles.

② **Manifest tetany:** (Serum Ca < 7 mg/dl).

- ♦ Irritability, restlessness, parasthesia around the mouth.
- ♦ Carpo-pedal spasm:
 - Carpal ⇒ (flexed adducted thumb, flexed MCP and wrist and extended DIP and PIP).
 - Pedal ⇒ (plantarflexion with the toes flexed).
- ♦ Spasm of other muscles:
 - Facial muscles (Risus sardonicus).
 - Mastication muscles (Trismus of the jaw).
 - Laryngeal muscles (Stridor).
 - Diaphragm (Hiccough).
 - Back muscles (Opisthotonus).

③ **Effect of hypocalcaemia:**

- Hair → alopecia
- Skin → atrophy
- lens → cataract.
- Nail → brittle
- Teeth → hypoplastic with holes and furrows..

* **Investigations:**① **In hypocalcaemia:**

- Low serum Ca (Normally 9-11 mg/dl).
- High serum Ph (Normally 4.5-6.5 mg/dl).

② **In alkalosis:** High pH of the blood (Normally 7.35-7.45).③ **In hypomagnesaemia:** Low serum magnesium (Normally 1.7-2.4 mg/dl).* **Treatment:**

① Acute attack: Ca gluconate 10% (1-2 ml/kg I.V. slow)

② Treatment of the cause if curable.

③ Supplementation of the deficit:

- In Ca deficiency → Ca or Vit. D (oral).
- In Mg deficiency → Mg (oral).
- In Alkalosis → Acidifying salts and rebreathing into a paper bag.

RICKETS

Metabolic disorder resulting from failure of mineralization of osteoid tissue in growing bone.

CLASSIFICATIONS**1st classification****I- Essential calcium deficiency:**

- ① Responsive to normal doses of vit. D:
(Vitamin D deficiency rickets)
- ② Responsive to high doses of vit. D:
 - a- Hepatic disease
 - b- Malabsorption.
 - c- Anti-convulsant drugs.
 - d- Renal glomerular disorders.
 - e- Hypocalcaemic vit. D dependant rickets type I.

II- Essential phosphorus deficiency:

- ① Renal tubular disorders (congenital and acquired).
- ② Oncogenic rickets

III- End organ resistance to vit. D:

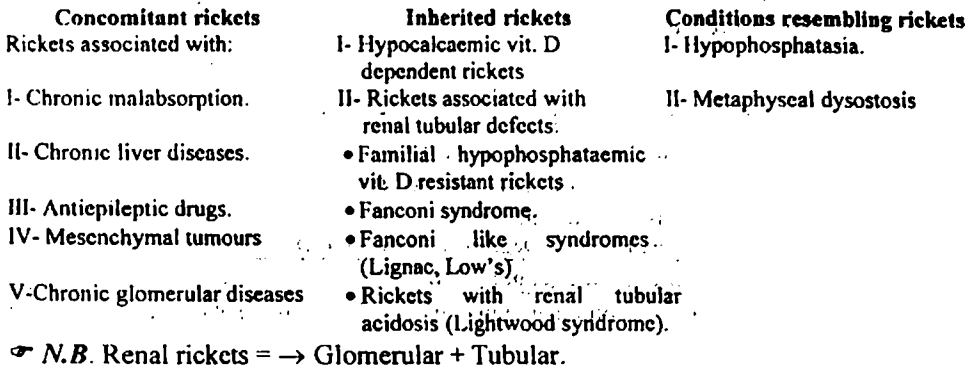
Hypocalcaemic vit. D dependant rickets type II.

IV- Conditions resembling rickets:

- ① Hypophosphatasia.
- ② Metaphyseal dysostosis.

2nd classification

- ① Vitamin D deficiency rickets (infantile rickets)
- ② Non vitamin D deficiency rickets (Refractory rickets):



VITAMIN D DEFICIENCY RICKETS

Infantile rickets

* Predisposing factors:

- ① Sex: Male are more affected which may be attributed to presence of locus on X-chromosome which protect against the development of rickets.
- ② Age: • From 6 months • Peak 18 months • End at 3rd year.
- ③ Race: Common in black races.
- ④ Location: More in cities than rural areas.
- ⑤ Feeding: Common in artificially fed infants.
- ⑥ Convalescence from diseases.
- ⑦ Season: Common in winter.
- ⑧ Growth: More common in rapidly growing infants (Twins, preterm, ...) and rare in arrested growth (PEM, cretinism,).

* Aetiology:

① Dietary causes:

* Poor intake of vit. D.

* Disturbance in Ca and Ph (rare)

→ Poor intake of Ca and Ph.

→ ↓ Ca absorption (e.g phytic acid present in cereals)

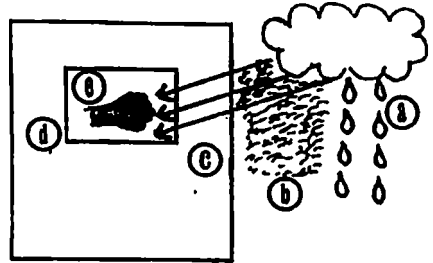
→ Unsuitable Ca/Ph ratio.

② Impaired Vit. D absorption:

* Increase vitamin loss e.g. recurrent G.E.

③ Failure of vit. D activation in the skin:

- a- Winter → ↓ ultraviolet rays (UVR).
- b- Excess dust and dampness → ↓ UVR.
- c- Over crowding and high buildings.
- d- Glass windows → prevent UVR
- e- Dark skin → prevent penetration.



✱ Pathology:

✱ 2 types of ossification normally occurs:

- Subperiosteal → leads to increase bone thickness.
- Intracartilagenous → leads to ↑ length (as it occurs in epiphysis)

✱ Zones from epiphysis inward are called:

1- Resting cartilage 2- Proliferating cartilage 3- Degenerated cartilage 4- Ossification 5- Preformed bone.

	Normal intracartilagenous ossif.	Rachitic changes
I- Zone of resting cartilage	• Single layer of columnar epithelium.	• No or minimal change.
II- Zone of proliferating cartilage	• Avascular with no Ca^{++} • Formed of 4-6 layers of regularly arranged cells.	• Very vascular, enlarged • The cells becomes irregularly arranged.
III- Zone of degenerating cartilage "Provisional calcification"	• Ca deposition occurs • Cells become swollen ⇒ Formation of sharp line at shaft and on X-ray "epiphyseal line"	• No Ca deposition • Invaded by the proliferating cartilage → irregular epiphyseal line.
IV- Zone of ossification	• Vascularization of the cells • Osteoblasts deposit osteoid materials which will be mineralized → bone formation.	• Deposition of uncalcified osteoid tissue leading to: - ↓ bone density - ↓ bone rigidity so bone becomes liable for deformity, green stick fracture,
V- Zone of preformed shaft bone.	• Normal bone	• Resorption occurs and replaced by uncalcified osteoid tissue from periosteum.

★ Biochemical Changes:

- 1- Normal serum calcium (N. 9-11 mg/dl).
- 2- Serum phosphorus ↓↓ (N. 4.5-6.5 mg/dl).
- 3- Serum alkaline phosphatase ↑↑ (N. 150-450 IU/L).
 - ⇒ The most important indicator of rachitic activity.
 - ⇒ ↑ in all conditions stimulating osteoblastic activity e.g. Rickets, osteomalacia, hyperparathyroidism.
 - ⇒ May not increase if rickets is associated with severe protein/for zinc deficiency
- 4- Howland formula ($\text{Ca} \times \text{P}$): ↓↓ (N. 50).
- 5- Plasma parathormone level: ↑↑ (N. 10-60 Pg/ml).
- 6- Plasma 25 (OH) cholecalceferol & 1,25 Di(OH) cholecalceferol ↓↓.

★ Pathogenesis of biochemical changes:

- 1- ↓ 1,25 Di (OH) CCF → ↓ Ca absorption → ↓ serum Ca.
- 2- ↓ serum Ca → stimulation of parathyroid → parathormone hormone → Ca & Ph mobilization from bone and ↑ Ph urinary excretion.
- 3- The net result of above will be normal serum Ca & low serum Ph & and ↓ bone mineralization.
- 4- However serum Ca may fall and tetany occurs if:
 - Failure of physiological hyperparathyroidism to occur.
 - Depletion of bone Ca^{++} (advanced cases).
 - Initiation of therapy with high dose of vitamin D (shock therapy) leading to deposition of Ca & Ph in bone at the expense of serum Ca which falls:

★ Radiological Changes:

- Best detected at the lower ends of long bones esp. radius and ulna because they are sites of rapid growth with thin soft tissue and easy access.

A) Active Rickets

- Lower ends of radius and ulna shows chch triad of widening, cupping and fraying
- The joint space distance between the lower ends of radius and ulna and carpal bones is wide as the uncalcified rachitic metaphysis do not appear on x-ray.
- The shaft shows decrease density ± fractures.
- Deformity of the shaft (e.g. bowing) may be present



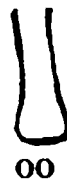
B) Healing Rickets

- Concave irregular interrupted line appears at the zone of provisional calcification (preparatory zone)



C) Healed Rickets

- Straight, continuous transverse line appears at the zone of provisional calcification



• Clinical Manifestations:

⊕ Early Rickets

1- General: Anorexia, irritability and excess sweating.

2- Craniotabes:

It's egg shell crackling sensation elicited by pressure on the occipital or posterior parietal bones (just above and posterior to the auricle), in rickets it occurs early and usually disappears by the age of 1 year.

Elicited by holding the infant's head between the palms of the hands with the thumb over the forehead and the fingers fanned out over the occiput. With gentle pressure the back of the skull yields under pressure as a ping-pong ball and return back after releasing pressure.

3- Rachitic rosaries

It is palpable enlargement of costochondral junction due to excess osteoid deposition

⊕ Late Rickets

1- Head:

- Anterior fontanelle is wide with delayed closure.
- Assymetry may present.
- Big head (may remain for life).
- Bossing (thickening of the central parts) of the frontal and parietal bones.
- Caput quadratum (box shaped skull) results from bossing of parietal & frontal bones with flattened occiput.
- Craniotabes but disappears by one year.
- Delayed teething with tendency to develop caries.
- Depressed nasal bridge secondary to frontal bossing.

2- Thorax

- Pigeon Chest: Mid sternum and its adjacent cartilages appear to be projected forward with depressed lower end.
- Rachitic rosaries: Not only palpable but also visible.
- Longitudinal sulcus: Posterior to the line of rosaries due to yielding of the chest at its weakest point "costochondral junction" under the effect of the atmospheric pressure versus -ve intrathoracic pressure.
- Harrison sulcus: Transverse groove along the costal insertion of the diaphragm due to diaphragmatic pull on soft ribs during respiration.

3- Vertebral Column

Occurs as a results of weakness of paravertebral muscles & relaxation of spinal ligaments.

- Scoliosis: lateral curvature of the spine.
- Kyphosis:
Smooth.
In dorsolumbar region.
Apparent (Appears in sitting & disappears when held erect).

4- Extremities:

- **Widening of the epiphysis:** of long bones (esp. Wrist & ankles).
- **Marfan sign:** Transverse groove felt over the medial malleolus due to unequal growth of the two ossific centers from which medial malleolus develops.
- **Green-stick fractures:** which means fracture of the cortex of one side of long bones with no bone separation.
- **Deformity of the limbs:**
 - Genu vulgum (knock knee).
 - Genu varum (bow legs)
 - Genu recurvatum (over extended knees).
 - Bowing of the forearm (seen in creeping children).

5- Pelvis:

- **Contracted inlet:** due to forward displacement of sacral promontory.
- **Contracted outlet:** due to forward displacement of the lower part of the sacrum (Both in female may lead to obstructed labour later on life).

6- Muscles and ligaments

Hypotonia of the muscles and laxity of ligaments are common mainly due to hypophosphataemia, this will lead to:

- Delayed milestones of motor development.
- Umbilical hernia.
- Constipation. (Intestinal hypotonia).
- Abdominal distention (Pot-belly abdomen) is common due to intestinal hypotonia, abdominal wall muscle hypotonia and ptosis of liver & spleen due to chest deformity.

*** Complications:**

- 1- **Respiratory complications:** Pulmonary infection and lung collapse are common due to limited chest expansion as a result of chest deformities.
- 2- **GIT complications:** Despite of common presence of constipation as mentioned before, attacks of G.E. are common due to stasis of intestinal contents and therefore secondary bacterial infection.
- 3- **Skeletal deformities:** These deformities may disappear completely if mild case with early treatment but may persist in severe & advanced cases.
- 4- **Tetany:** Can occur if serum Ca falls below normal (see before).
- 5- **Anaemia:** Especially iron deficiency anaemia.

★ Differential Diagnosis:

- 1- Other causes of large head (See later).
- 2- Other causes of craniotables:
 - Normal neonates especially prematures.
 - Hydrocephalus (all bones of the skull).
 - Osteogenesis imperfecta (frontal parts of the skull).
 - Congenital \$
 - Hypervitaminosis A.
- 3- Other causes of delayed anterior fontanelle closure. (See before)
- 4- Other causes of depressed nasal bridge:
 - Constitutional.
 - Chronic hemolytic anemia.
 - Congenital \$.
 - Cretinism.
 - Mongolism.
- 5- Other causes of delayed teething. (See before)
- 6- Chest deformities from other causes e.g. congenital & chronic asthmatics.
- 7- Scurvy: Tender bones, swollen gums, angular deformities of the sternocostal junction "scarpulic rosaries", liability for bleeding.
- 8- Other causes of kyphosis esp. Pott's disease in which kyphosis is non reducable, & angular.
- 9- Other causes of inability to walk (See later).
- 10- Other causes of short stature e.g. Achondroplasia: (AD disease characterized by disproportionate dwarfism, large head, lumbar lordosis & waddling gait.
- 11- Rickets of vitamin D deficiency must be differentiated from non-vitamin D deficiency rickets.

★ Management of Rickets

(I) Prophylactic:

- 1- Frequent exposure to sunlight especially during the summer in haze-free areas.
- 2- Prophylactic vitamin D administration for both breast fed or fresh animal milk fed babies:
 - In full term: 400 IU/day from the 4th month.
 - In prematures: 1000 IU/day from the 1st-2nd month.
 (Most of dried and condensed milks are fortified with vitamin D so not need addition of vit. D).
- 3- Prevent weight bearing during active stage of the disease to minimize incidence of deformities.

(II) Curative:

- 1- Oral vitamin D administration either:
 - * D3 2000 - 6000 IU (50 - 150 ug /day) or
 - * 1,25 (OH) CCF (0.5 ug/day).
- 2- Parenteral vitamin D administration either:
 - * Daily injection: 3000 IU/day I.M (not recommended).
 - * Shock therapy: 600,000 IU. I.M & may be repeated after 2 week (up to 3 injections).
- 3- Adequate Ca supply during treatment especially with shock therapy to prevent possible hypocalcemia.

N.B.

- If no healing occurs the rickets is probably resistant to vitamin D.
- If healing is complete the dose of vitamin D is reduced to the normal requirement (400 IU = 10Ug/day).

(III) Treatment of Complications

- 1- Treatment of respiratory or GIT complications.
- 2- Rapid treatment of tetany if occurs (Ca gluconate 10% IV).
- 3- Orthopedic surgical correction of residual deformities after complete healing.

(IV) Criteria of Improvement

- 1- **Radiological improvement:** The earliest character of improvement starts with appearance of the line of preparatory calcification (about 2 weeks after starting treatment).
- 2- **Biochemical improvement:** especially normalization of alkaline phosphatase level which indicates end of the rachitic process.
- 3- **Clinical improvement:** including appetite, muscle tone,
- 4- **Skeletal improvement:** as rosaries, bossing, widening of bone ends, knock knee,..... takes long time for improving and may remain for life.

✱ Prognosis of Rickets

- Rickets is non fatal disease even without treatment but frequent GIT or chest complications may progress and lead to death.
- Early treatment will lead to healing without residue but incomplete and delayed treatment may result in permanent deformities.

REFRACTORY RICKETS

(I) Concomitant Rickets

		1- R. with Ch. malabsorp.	2- R. with Ch. liver dis.	3- R. with antiepileptics
Pathogenesis		Associated with malabsorption syndrome e.g. Coeliac disease, cystic fibrosis, ... because vitamin D is fat soluble, so in malabsorption of fat $\rightarrow$ $\downarrow$ vit. D absorption.	a) Biliary disease $\rightarrow$ fat malabsorp. $\rightarrow$ $\downarrow$ abs. of Vit. D. b) Hepatocellular disease $\rightarrow$ $\downarrow$ hydroxylation to 25 (OH) CCF.	- Phenytoin and phenobarbitone are enzyme inducers so $\uparrow$ hepatic inactivation of Vit. D. - Direct inhibition of Ca absorption from GIT. - Epileptic patient usually lacks sun exposure
Diagnosis	Serum Ca	Normal or $\downarrow$	Normal or $\downarrow$	Normal or $\downarrow$
	Serum Ph	$\downarrow$	$\downarrow$	$\downarrow$
	Alk. Phos	$\uparrow$	$\uparrow$	$\uparrow$
	Others	Steatorrhea	Abnormal liver function tests	History of treatment from epilepsy
Management		- Treatment of the cause. - Vit. D. injection (not oral).	- Treatment the cause. - Vit. D. injection (not oral).	- Prophylaxis: 500-1000 U of Vit. D daily more than the daily needs + sun exposure. - Curative. $\uparrow$ dose of vit. D or 25 (OH) CCF

4- **Rickets with mesenchymal tumours:** Some tumours can be complicated by rickets due to phosphate loss.

5- **Rickets with chronic glomerular diseases:** "Renal osteodystrophy"

☐ **Aetiology:** Any condition resulting into chronic renal failure as:

- Chronic glomerulonephritis, chronic pyelonephritis,

☐ **Pathogenesis:** CRF will lead to:

- $\downarrow$ α_1 hydroxylation (due to $\downarrow$ 1,25 (OH)₂ CCF)
- Phosphate retention.
- 2ry hyperparathyroidism ($\uparrow$ parathormone) $\rightarrow$ $\uparrow$ Ca mobilization from bone (Bone resorption) $\rightarrow$ osteitis fibrosa cystica.

☐ **Clinical Manifestations**

1- Manifestations of CRF.

2- Manifestations of rickets (No tetany as CRF is usually accompanied with acidosis which $\uparrow$ ionized Ca).

❑ Laboratory Data:

- Ca: Slightly ↓
- Ph: ↑
- Ca × Ph: ↑↑
- Alkaline phosphatase: ↑↑
- Parathormone: ↑↑
- Normal 25 (OH) CCF with ↓ 1,25 Di (OH) CCF.
- Data of CRF. (e.g. ↑ blood urea & creatinine)

❑ X-ray findings:

- Subperiosteal erosions of bones esp. middle & distal phalanges.
- Bone cysts (osteitis fibrosa cystica).

❑ Treatment:

- Management of CRF.
- Control of hyperphosphataemia:
 - ◆ a low phosphorus diet or formula.
 - ◆ Phosphate chelators: (calcium carbonate or acetate are better than aluminum hydroxide gel for risk of aluminum toxicity).
- Oral Ca supplementation.
- Active vitamin D (calcitriol) and treatment should be monitored with PTH level.
- Newer activated vitamin D analogues such as paracalcitol and doxercalciferol are increasingly used.

(II) Conditions resembling Rickets

Hypophosphatasia

- AR disease characterized by ↓ serum alkaline phosphatase
- Manifested with:
 - Congenital lethal form.
 - Severe infantile form.
 - Mild childhood form.

Metaphyseal Dysostosis

- AD orthopedic disease of 2 types Jansen type and Schmidt type.
- Manifested with:
 - Short stature.
 - Bow legs.
 - Waddling gait.

(III) Inherited Rickets

○ Hypocalcaemic Vit. D dependent rickets

❑ AR disease with 2 types

- Type I → ↓↓ $\alpha 1$ hydroxylase in kidney → failure of synthesis of 1,25 (OH)₂ CCF.
- Type II → end organ resistance to vit. D. (deficiency of receptors).

❑ Manifestations: Early manifestations of rickets (3-6 months).

❑ Laboratory:

- Low serum Ca & Ph
- High serum alkaline phosphatase.

❑ Treatment:

- ↑ doses of vit. D especially 1,25 (OH)₂ CCF.

□ Renal Tubular Rickets

	1- Familial hypophosphatemic Vit D resistant rickets	2- Denton-DeBri Fanconi syndrome	3- Cystinosis (Lignac syndrome)	4- Oculo cerebro renal (Lowe syndrome)	5- Renal tubular acidosis (Light Wood syndrome)
Aetiology	• X linked dominant, characterized by decrease renal tubular reabsorption of phosphate → loss of Ph. in urine	• AR disorder (also may be acquired) Ch. by multiple defects in proximal renal tubules with ↓ urinary reabsorption of Ph, Bicarbonate, K, glucose & A.A. and their loss in urine	• AR disorder similar to Fanconi associated with excess cystine crystals and their deposition in liver, spleen, B.M, WBC'S and cornea	• X-linked recessive disorder similar to Fanconi with ocular, cerebral and renal manifestations	• ± AR disorder Ch. by defective bicarbonate reabsorption from the kidney with H⁺ retention So failure to produce acid urine + metabolic acidosis in the blood
Manifestations	• Usual rachitic manifestations during the 2nd year of life especially bow legs with good general condition	• Manifestations of rickets. • Nausea, vomiting & constipation. • Polyuria, polydipsia & dehydration • Metabolic acidosis	• Similar to Fanconi • Marked photophobia.	• Ocular: cataract or glaucoma. • Cerebral: hyptonia, hyporeflexia & M.R. • Renal: As Fanconi	• Similar to Fanconi
Investigations	• ↓ Ph • Normal Ca⁺ • ↑ Alk. Phosphatase • Normal parathormone.	• The same as familial hypoph. • ↑ urinary glucose, A.A., bicarbonate, Ph, and K. • Metabolic acidosis in blood	• As Fanconi + detection of cystine crystals in WBC's or cornea (slit lamp)	• As Fanconi	• Hyperchloraemic metabolic acidosis. • ↓ pH
Treatment	• Large dose vit. D. • Oral phosphate supply (1-2 gm/day)	• Large dose vit. D. • Oral phosphate supply (1-2 gm/day). • Correction of acidosis Na Bicarbonate (2 meq/Kg/day)	• As fanconi + cystine chelating agents (Cysteamine)	• As Fanconi + Management of associations (cerebral-Ocular)	• As Fanconi

N.B. Large doses of Vit. D =

- Vit. D₃ → 50,000-100,000 IU/day
- 25 (OH) CCF → 20-50 µg/day.
- 1,25 (OH)₂ CCF → 2-20 µg/day.

N.B. Renal rickets =

- Renal glomerular rickets
- Renal tubular rickets

CHAPTER (V)

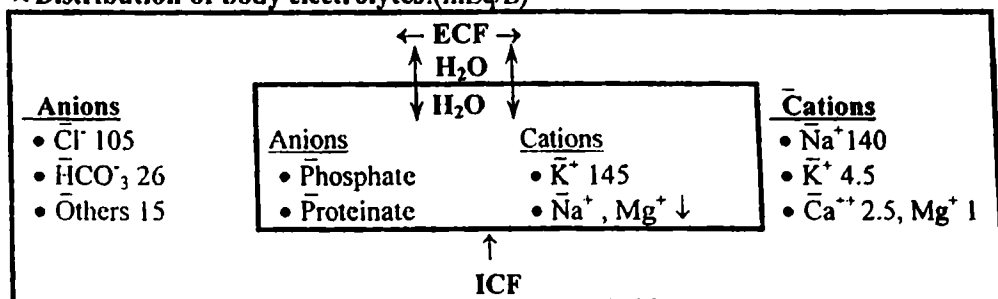
DEHYDRATION AND DIARRHEA

Body fluids & electrolyte balance

Water forms 60% of total body weight of adult and 75% of total body weight of infant, increase or decrease of body water may lead to serious complications esp. in infants with higher body water > adults.

☆ Distribution of body water:

- 2/3 as intracellular water.
- 1/3 as extracellular water (Plasma, interstitial fluid).

☆ Distribution of body electrolytes:(mEq/L)

Dehydration

☆ Definition:

Loss of fluids ± electrolytes from the extracellular compartment, ICF may be secondarily affected.

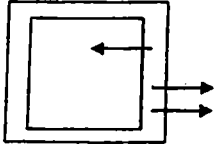
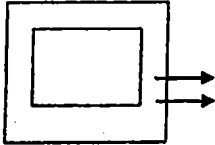
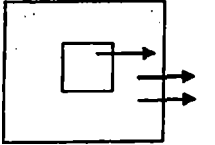
☆ Causes of dehydration:

1. Diarrhea (The most common cause in developing countries)
2. Vomiting (e.g. pyloric stenosis, intestinal obstruction.....)
3. Polyuria (e.g. DM, DI, CRF, diuretics, hypercalcemia.....).
4. Skin loss (e.g. burn, excessive sweating)
5. Lung loss (e.g. hyperventilation)
6. ↓ fluid intake (e.g. starvation, coma,.....)

☆ Degrees of dehydration:

	<u>Body wt. loss</u>		<u>Clinical</u>
- Mild	< 5 %	→	Few manifestations
- Moderate	5-10 %	→	Full picture of dehydration
- Severe	> 10 %	→	Manifestations of shock

☆ Types of dehydration:

	• Hypotonic "hyponatraemic" dehydration	• Isotonic "isonatraemic" dehydration	• Hypertonic "hypernatraemic" dehydration
☆ Mechanism	• Loss of electrolytes > water loss with cellular overhydration and (ECF) collapse	• Loss of electrolytes = water loss with normal cellular hydration and (ECF) collapse	• loss of electrolytes < water loss with cellular dehydration and normal (ECF)
☆ Serum Na ⁺	• < 130 mEq /L	• 130 - 150 mEq/L	• > 150 mEq / L
			
* Manifestations of (ECF) collapse:			
☆ Depressed A.F.	→ + + +	++	(± bulging)
☆ Sunken eyes	→ + + +	++	±
☆ Skin turgor loss	→ + + +	++	±
* Manifestations of (ICF) collapse			
☆ Tongue, m.m.	→ - Moist	- Dry	- Very dry "woody"
☆ Brain cell affection " By ↑ or ↓ fluids"	→ - Lethargy ± coma	- Irritability	- Irritability or even convulsions

N.B. → Hypernatraemic dehydration may be misdiagnosed due to few manifestation and so needs high incidence of suspicion.

Rehydration

Amount of fluids needed:

* **Shock therapy:** (used in shock or severe dehydration)

20-30 ml/kg in ½ - 1 hour (IV).

* **Deficit therapy:** (replacement of abnormal water and electrolyte loss due to disease process before medical examination) → in mild - moderate dehyd.
50-100 ml/kg in 2½ - 5 hours (IV or oral).

* **Maintenance therapy:** (provision of the maintenance requirements of water and electrolytes due to normal daily loss)

100 ml/kg → for weight up to 10 kg.	} (IV)
50 ml/kg → for 11-20 kg.	
20 ml/kg → for 21-30 kg.	
10 ml/kg → for weight above 30 kg.	

Types of fluids used:**(I) Oral fluids: (ORS)**

☆ Rehydran: Each sachet contains

{	Glucose 4 grams
	Na cl 0.7 gram
	Na HCO ₃ or Na citrate 0.5 gram
	Kcl 0.3 gram

to be dissolved in 200 c.c water.

N.B.

- The ideal (ORS) recommended by WHO has the same ratio of ions as rehydran but the amount is increased to be dissolved in 1 litre of water.
- Lohydran is another ORS formula which contains low amount of Nacl so ideal for hypernatraemia

☆ Mechanism of (ORS):

The ORS is based on the theory which states that at certain concentration of glucose and Na, Na absorption will be maximum. ORS also supplies the body with the lost electrolytes and water as water absorption usually follows Na⁺.

☆ Uses of (ORS) → advantages:

1. All types of dehydration can be corrected by ORS.
2. Can be given at any age (even in the newborn)
3. Effective in diarrhea whatever the cause.
4. Fever, vomiting or acidosis are not contra indications to ORS

☆ Limitation of (ORS) use:

ORS is not effective in:

1. Initial rehydration in severe dehydration (shock).
2. Rapid loss of stool (> 15 ml / kg / hour) as rate of ORS intake will not be sufficient.
3. Paralytic ileus and marked abdominal distention.
4. Glucose malabsorption (rare): as glucose is the main component of ORS. (even diarrhea may worsen)

(II) Parenteral fluids:*A- Electrolyte containing solutions:*

☆ Physiological saline (Na⁺ 154 mEq / L , cl⁻ 154 mEq /L) it is unphysiological and contains excess cl⁻ which may lead to hyperchloraemia, it may also lead to hypernatraemia.

☆ Ringer solution (mEq /L)

Na ⁺	147
Cl ⁻	154
K ⁺	4
Ca ⁺⁺	4



Still cause hyperchloraemic acidosis

☆ Lactated Ringer (mEq /L)

Na ⁺	131
Cl ⁻	111
K ⁺	4
Ca ⁺⁺	4

Lactate 26 mEq / L



Containing less Cl, ↑↑ lactate to prevent acidosis

☆ Polyvalent (mEq /L)

Na ⁺	90
Cl ⁻	65
K ⁺	15
Glucose	111
Acetate	40



Similar in ratios to ORS but given I.V.

☆ Potassium Containing Solutions

A- KCL 15%

B- kadalex = Glucose 5 % + 27 mEq / L K⁺, 27 mEq / L Cl⁻.

Potassium should be given cautiously:

1. not given except after good urine flow.
2. not given direct I.V. (given in I.V. infusion)
3. not given in acidosis (Acidosis shift K extracellular → hyperkalaemia).

☆ Sodium bicarbonate or Na lactate

in cases of acidosis (Na bicarbonate is better, as Na lactate must be metabolised at the liver firstly to give Na bicarbonate).

B- Non electrolyte containing solutions.

☆ Dextrose either 5 % (in well nourished baby) or 10 % in PCM. Not given alone but with one of the electrolyte containing solutions as glucose alone will not be retained in ECF without electrolytes.

☆ Amino acid solutions: In prolonged IV fluids with emaciation

☆ Blood or plasma: In shock or severe dehydration.

Routes of fluid administration

1) Oral →

- ☆ Mild - moderate cases
- ☆ Conscious
- ☆ No or mild vomiting

2) Naso - gastric →

- ☆ Frequent vomiting.
- ☆ Refusal of oral in mild- moderate cases.
- ☆ Failure of venous access

3) I.V. route →

- ☆ Severe dehydration, shock.
- ☆ Comatosed child.
- ☆ Persistent vomiting

4) Intraosseous →

- ☆ Severe dehydration with failure of venous access (temporarily until venous access can be established).

Diarrheal Disorders

● **Diarrhea:**

↑ fluidity, ↑ volume or ↑ frequency of stools relative to the usual habits of the individual (Diarrhea can be also defined as passage of more than two watery motions per day or single motion containing blood and mucus).

● **Normal stool pattern:**

- Birth → 4 months - Breast fed infants (1-7 motions/day)
- Bottle fed infants (2-3 motions/day)
- 4 → 12 months - 1-3 motions / day which is firm
- > 1 year - 1-2 motions / day which have adult like characters.

● **Conditions wrongly considered as diarrhea:**

1. Frequent loose yellow stools of breast fed infants.
2. Starvation diarrhea: small, greenish motions with mucus.
3. Greenish motions: Due to hurried intestinal movement and ↑ biliverdin content of stool. It is physiological process can occur in any child without significance.

● **Classification of diarrhea:**

- 1- Acute diarrhea: Diarrhea which begins acutely and persists less than 14 days.
- 2- Dysentery: Acute diarrhea with blood in stool.
- 3- Persistent diarrhea: Begins as acute but persists > 14 days.
- 4- Chronic diarrhea: Diarrhea of gradual onset with recurrent or long standing course (usually persists more than one month).

(I) ACUTE DIARRHEA

● **Definition:** Diarrhea which begins acute and lasts less than 14 days

● **Epidemiology:**

- Diarrhea is the greatest killer in developing countries including Egypt, in which diarrhea represents 25% of the causes of death under five years.
- Each child under 5 yrs in Egypt is suspected to have three episodes of diarrhea at least every year.

● **Risk factors:**

1. **Host factors:** Young age (< 6m.), malnutrition, immunodeficiency and measles.
2. **Maternal behavior:** Use of contaminated bottles, failure of hand wash & disposal of feces.
3. **Environmental factors:** Contaminated food & seasonal variation.
4. **Bottle feeding:** Carries high risk of contamination.

● **Aetiology:** (most common under 5 years rota virus , ETEC, shigella , campylobacter and cryptosporidium)

1- **Infective diarrhea (G.E.):**

1- **Viral diarrhea** (> 60%):

- Rota virus (the commonest) • Enteroviruses (ECHO, Coxsackie)
- Adenoviruses. • Norwalk virus.

**** Chch of viral diarrhea:**

- Mainly in winter.
- Mild severity.
- Mild fever ($< 38.5^{\circ}$)
- Always watery diarrhea.

2- Bacterial diarrhea:

- E. coli (entero-toxicogenic, entero-pathogenic and entero-invasive)
- Shigella.
- Campylobacter jejuni.
- Salmonella.
- Cholera.

**** chch of Bacterial diarrhea:**

- Mainly in summer.
- May be severe.
- High fever ($> 38.5^{\circ}$).
- May be watery or bloody diarrhea.

3- Parasitic diarrhea:

- Giardia lamblia.
- Cryptosporidium.
- Entamoeba histolytica.

4- Mycotic diarrhea:

Candida albicans may cause diarrhea in debilitated or immuno-deficient children.

II- Non-infective diarrhea:

1- Dietetic errors:

- Over feeding.
- Under feeding (Starvation diarrhea)
- Change of type or concentration of milk.
- Addition of new food not suitable for the age of the child.

2- Drug induced:

- Prolonged antibiotic therapy (e.g. ampicillin).
- Excess laxatives.

3- Parenteral diarrhea:

Occurs in infections outside the GIT due to toxic absorption or reflex GIT irritation. It is better called 2ry GE as the term parenteral is no longer used now.

Example: Diarrhea with pneumonia, otitis media, bronchitis.

*** Pathogenesis of diarrhea:**

1- Viral diarrhea:

✧ **Secretory diarrhea:**

Virus invades the absorptive cells of the villi $\rightarrow$ destruction, which is replaced by secretory cells which migrate from the intact secretory cells of the crypts, this will lead to $\uparrow$ secretion, $\downarrow$ absorption $\rightarrow$ severe diarrhea.

Secretory diarrhea is not affected by fasting (stool shows - ve reducing substances & $\text{pH} > 6$).

✧ **Osmotic diarrhea:**

Villous damage $\rightarrow$ loss of disaccharidase enzymes at the brush border of the villi so disaccharides (e.g. lactose) remain in the intestine, creating a high osmotic pressure imbibes water from inside the intestinal cells $\rightarrow$ diarrhea.

Osmotic diarrhea is $\downarrow$ by fasting (stool shows +ve reducing substances & $\text{pH} < 5$).

2- Bacterial diarrhea:✧ **Mucosal adhesion:**

Bacteria adheres to intestinal mucosal epithelium by fimbria, pilli, villi so interfere with absorption and/or ↑ secretion e.g. Enteropathogenic E.coli.

✧ **Mucosal invasion:**

Bacteria invades intestinal mucosal epithelium → destruction → loss of absorption & ↑ secretion e.g. Enteroinvasive E. coli, Shigella, Campylobacter & salmonella

✧ **Toxin secretion:**

Bacteria releases enterotoxins which stimulate cyclic AMP in intestinal cells → ↓ absorption and / or ↑ secretion e.g. Enterotoxigenic E coli & Cholera.

3- Parasitic diarrhea:

* **Mucosal adhesion:** e.g. Giardia lamblia.

* **Mucosal invasion:** e.g. Entamoeba histolytica.

* **Sequences of severe diarrhea** = Complications of G.E.**1- Dehydration:**

- ◆ **Due to:** - Fluid loss by vomiting, diarrhea or decrease intake
- ◆ **C/P:** - Manifestations of dehydr. (sunken eyes, depressed fontanel,....)

2- Shock:

- ◆ **Due to:** - Hypovolaemia (Hypovolaemic shock)
- Sepsis e.g. gram-ve bacteria (septic shock)
- ◆ **C/P:** - Poor peripheral perfusion (skin mottling, cold extremities)
- Tachycardia - Oliguria - Hypotension.

3- Renal failure:

- ◆ **Due to:** - Early, hypovolaemia → renal hypoperfusion.
- Gradually prolonged hypoperfusion → irreversible tubular damage → irreversible renal failure
- It may also occur due to toxemia, renal vein thrombosis or hemolytic uremic syndrome.
- ◆ **C/P:** - Oliguria or anuria

4- Metabolic acidosis:

- ◆ **Due to:** - Renal failure.
- Loss of alkali in severe diarrheal attacks.
- ◆ **C/P:** - Acidotic breathing - Disturbed consciousness. - Edema.

5- Electrolyte-disturbance:◆ **Hypokalaemia:**

- * Occurs in severe G.E. however acidosis masks hypokalaemia due to K^+ shift from ICF to ECF, so when acidosis is corrected severe hypokalaemia occurs.
- * Manifested by paralytic ileus (abdominal distention), weakness, hypotonia and may be cardiac arrhythmia.

◆ **Hypocalcaemia:**

- * Occurs in severe G.E. esp. hypernatraemic dehydration.
- * Manifested by tetany or convulsions.

◆ **Hypo or Hypernatraemia**

6- Convulsions:

- ◆ **Due to:**
- CNS infections e.g. shigella & neurotropic viruses may produce encephalitis
 - DIC → Intracranial hge. → convulsions
 - Electrolyte disturbance → hypocalcaemia, ↓ or ↑ Na.
 - Febrile convulsions

◆ **C/P:** Convulsions

7- Encephalitis:

◆ **Due to:** Shigella or neurotropic viruses

◆ **C/P:** Disturbed consciousness, convulsions, ↑ ICT, ...

8- Bleeding:

	<i>Due to</i>	<i>Clinically</i>
DIC	- Shock, sepsis, acidosis	- Necrotic skin patches, - Bleeding from puncture sites.
Hypoprothrombinaemia:	- ↓ Vit. K intake - Prolonged antibiotic ttt - loss of bacteria flora	- Bleeding from puncture sites ± skin ecchymosis
Intussusception	- Acquired invagination of part of intestine (usually ileum) in the colon	- Red current jelly stool - Abdominal pain+mass - Vomiting.
Renal vein Thrombosis	- Hypovolaemia, ↓ renal perfusion	- Haematuria - Flank mass.

9- Persistent diarrhea:

- ◆ **Due to:**
- Persistent aetiology of acute diarrhea.
 - Post enteritis malabsorption

◆ **C/P:** Diarrhea persists > 14 days

10- PCM:

- ◆ **Due to:** Faulty food restriction, anorexia, loss of nutrients in stool, and food intolerance. especially with recurrent attacks.

◆ **C/P:** Failure to thrive, marasmus or KWO.

• Investigations for acute diarrhea:**I- Investigations for the cause: (rarely needed)**

- Stool analysis (parasites, occult blood)
- Stool culture (In bacterial GE)
- CBC, CRP (In bacterial GE)

II- Investigations for the complications:

1. Renal function tests → for renal failure.
2. Arterial blood gases (ABG) → for metabolic acidosis (↓ PH & ↓HCO₃ & ↓PaCO₂). —
3. Serum electrolytes → for K, Na and Ca (+ECG for ↑ K).
4. Lumbar puncture → for meningitis, encephalitis.
5. Erect plain x - ray abdomen, Abdominal US → for intussusception.
6. Coagulation profile (P.T, P.T.T., FDP's) → for DIC & hypoprothrombinaemia.

* **Management of acute diarrhea:****I- ASSESSMENT OF PLAN OF MANAGEMENT**

	Plan (A) No dehydration	Plan (B) Some dehydration	Plan (C) Shock
General ☆ appearance	- Normal	- Irritable	- Shocked (lethargy)
Eye	- Normal	- Sunken	- Deep sunken
Mouth ☆	- Wet tongue - Normal drinking	- Dry tongue - Drinks eagerly	- Woody tongue - Unable to drink
Skin turgor ☆	- Normal	- Goes back slowly	- Goes back very slowly
Others - Ant. fontanelle - Tears - Signs of shock	- Normal - Present - Absent	- Depressed - ± Absent - Absent	- Depressed - Absent - Present (↓ BP, weak rapid pulse, oliguria or anuria).

☆ key signs of dehydration

II- TREATMENT OF ACUTE DIARRHEA

* Fluid therapy * specific ttt * symptomatic ttt * ttt of complications

A) Fluid therapy:**❖ Plan A (Home management)**

Patients with plan A are presented with diarrhea only without any signs of dehydration so, objectives are:

- Give more fluids to avoid dehydration.
- Give more food to avoid malnutrition.
- Follow up to detect any sign of dehydration.

1) Fluids:**◆ ORS (Rehydran):**

- < 2 years → 50-100 ml for each loose motion by spoon
- > 2 years → 100-200 ml for each loose motion by cup

◆ Other fluids beside ORS:

- Continuation of breast feeding (or formula feeding).
- Rice water, lemon or apple juice.
- Avoid hyperosmolar fluids (e.g. sweat teas, soft drinks) as it may lead to osmotic diarrhea.

☞ **N.B.** → As ability of infant to drink ORS is self-limited some authors prefer to let the infant to drink ORS as much as he wants with good spacing between spoons (e.g. 2 minutes interval)

2- Food:

- Continue the same milk for feeding (Breast or formula)
- For older infants (> 6 months) other semisolid foods can be given (e.g. mashed potatoes, rice pudding, vegetable soup, cereals,...), better small frequent feeding (e.g. every 4 hours) to avoid vomiting.

3- Follow up:

The mother should be strictly informed for urgent seeking medical advice if one of the following occurs:

- High fever or bloody diarrhea.
- Frequent vomiting.
- Sunken eyes.
- Lethargy and complete refusal of oral fluids.
- No improvement after 3-5 days.

❖ **Plan B (Hospital management)** = Mild to Moderate dehydration.

1- Fluids:

- * ORS 75 ml/kg given over 4 hours by spoon preferably at slow rate (1 spoon every 2-3 minutes).
- * If dehydration is present and the child refusing ORS, the calculated amount may be given through nasogastric tube.
- * If persistent vomiting 70 ml/kg of Glucose 5% & normal saline mixture of 4:1 is given I.V over 5 hrs (< 1 year old) or 2.5 hrs (> 1 year old) instead of oral ORS (N.B. Polyvalent is better than glucose: saline mixture)

2- Food:

- * During giving the ORS (4 hours) breast feeding can be given but artificial feeding is better substituted by plain water 100-200 ml by spoon.
- * After completion of the deficit therapy soft, semisolid foods may be given as plan A.

3- Assessment of child after ttt:

- * If no dehydration → Manage as plan A. (at home)
- * If still dehydrated → Repeat the deficit ttt again
- * If shocked (severe dehydration) → Manage as plan C.

❖ **Plan C (Hospital, may be ICU)** → severe dehydration = shock

- ♦ **Shock therapy:** 20-30 ml/kg (in one hour in infants < 1 year & in 1/2 hour in infants > 1 year).
The fluid is better given as Lactated Ringer solution, physiological saline or even plasma.

- After completion of the amount reassessment of the child is done:
 - Still shocked → repeat the shock therapy
 - Mild - Moderate dehydr. → 70 ml/kg in 5 hours (< 1 year) and in 2.5 hours (> 1 year) polyvalent solution.
- After full hydration the same maneuvers for fluid/food/follow up are done.

☞ **N.B.**

- 1- If IV line can not be obtained the previous amounts can be given intra-osseous.
- 2- If there is risk of overhydration (e.g. meningitis, respiratory distress, inappropriate ADH secretion) prolongation of the time of infusion or restriction of the amount of fluids to 70% will be indicated.
- 3- Number of drops / minute = $\frac{\text{Total amount}}{\text{N. of hours} \times 3}$

B- Specific treatment:

1- Antibiotics:

Antimicrobials are ineffective in most cases of diarrhea, they may even be harmful by:

- Prolongation of the duration of diarrhea by destroying the beneficial non pathogenic bacteria especially with salmonella infection.
- Some antibiotics has serious side effects.
- Increasing resistance of the organisms.
- Economic load on the family.

• Indications of antibiotic therapy:

• <i>Suspected shigella</i> ↓ (Severe diarrhea with visible blood)	→ Co-trimoxazole oral 48 mg/kg/day (in 2 doses) or chloramphenicol oral 50-100 mg/kg/d (in 4 divided doses).
• <i>Suspected cholera</i> ↓ (Severe rice water diarrhea)	→ Tetracycline 50-100 mg/kg/day oral divided (in 4 divided doses).

- **Most antibiotics are given** oral unless severe vomiting is present, antibiotics which can be given parenteral are (Ampicillin, Gentamycin and Cefotaxime).

2- Anti-parasitic:

If stool analysis reveals Entamoeba histolytica or Giradia lamblia vegetative forms, their ttt should be carried on (see page 112).

C- Symptomatic treatment:

- * **Antidiarrheal drugs:** As kaolin, pectin, smectite. They may change the character of stool from watery to semisolid but not affect the amount or frequency of motions so, these drugs have no role in management of diarrhea.
- * **Antimotility drugs:** As diphenoxylate (lomotil), are contra indicated as they lead to paralytic ileus.
- * **Antiemetic drugs:** The best management of vomiting is ORS slowly by spoon and giving small frequent feeding, Antiemetic drugs are either ineffective e.g. cortical extract or causing extrapyramidal manifestations e.g. metochlopramide.

D- Treatment of complications:**1- Renal failure:**

- ✧ TTT of dehydration by fluids usually improves renal perfusion.
- ✧ In late cases or cases not responding to ttt evaluation of renal function is important.
- ✧ Potassium must be avoided in the presence of oliguria.

2- Metabolic acidosis:

- ✧ In mild cases spontaneous correction occurs after fluid therapy.
- ✧ In severe cases NaHCO_3 5% is given slowly I.V. in a dose of 2 ml/kg with evaluation of blood gases.

3- Electrolyte disturbance:

- ✧ Hypokalaemia: Kcl is added to I.V. fluids.
- ✧ Hypocalcaemia: Ca gluconate 10% I.V.(1-2 ml/kg).
- ✧ Hyponatraemia: NaCl 3%.
- ✧ Hypernatraemia: - Fluids deficient in Na must be used during rehydration as Glucose: Saline 4:1. Polyvalent is also effective.
 - Correction must be slow to avoid brain oedema
 - Amount of fluids must be restricted to 60-70% of the usual amounts in other types of dehydration (60 % of deficit plus 70 % of maintenance).
 - Monitoring of serum Na and calcium during correction (serum Na should not decrease by more than 10 mEq/24 h).

4- Convulsions:

- ✧ Rapid control of the attack (e.g. diazepam I.V.)
- ✧ Then searching and ttt of the cause.

5- Bleeding:

- ✧ Vit. K injection for hypoprothrombinaemia.
- ✧ Plasma or blood transfusion → for DIC.
- ✧ Surgical consultation → for intussuception.

III- PREVENTION OF ACUTE DIARRHEA

- 1- Promotion of breast feeding & good weaning techniques.
- 2- Clean sewage disposable & use of latrines.
- 3- Prevention of infection by vaccination e.g. measles & Rota virus vaccines.

II- DYSENTRY

⊛ Definition:

Diarrhea with visible blood in stool. It accounts for 5-10% of diarrheal episodes in Egypt.

⊛ Causes:

- 1- Shigella.
- 2- Campylobacter jejuni.
- 3- Entero-invasive E.coli.
- 4- Salmonella (rare).
- 5- Entamoeba histolytica (uncommon before 5 years old).

⊛ Clinical picture:

- 1- Diarrhea which may begin watery for 1-2 days then becomes bloody with mucus and pus.
- 2- Crampy abdominal pain and tenesmus.
- 3- May be associated with fever or dehydration.

⊛ D.D.: * Volvolus * Inussuception * Ulcerative colitis.

⊛ Investigations:

- ⊠ Stool analysis for Entamoeba histolytica trophozoite.
- ⊠ Stool culture for bacterial causes.

⊛ Treatment:

- 1- Fluid therapy and feeding as usual. (see before)
- 2- In cases of Shigella: Cotrimoxazole (see before)
- 3- In cases of Amoeba: Metronidazole (see later)

III- PERSISTENT DIARRHEA

☆ Definition:

Diarrhea which begins as acute watery diarrhea or dysentery that persists more than 14 days (2 weeks).

☆ Incidence:

More common in developing countries (up to 10% of diarrhea persist > 14 days) which lead to malnutrition and high mortality rate.

☆ Causes:

1- Persistent infection:

All the causes of acute diarrhea may persist but Giardia lamblia, crypto spordium, salmonella and shigella are the most common causes.

2- Postenteritis malabsorption:

♦ **Mechanism:** severe GE → mucosal injury and villous damage → transient malabsorption till regeneration of the villi.

♦ **Forms:**

- **Lactose intolerance:** Loss of brush border enzyme lactase → No digestion or absorption of lactose → accumulation of lactose in the bowel → osmotic diarrhea.

As lactose is the main sugar in breast and cow's milk diarrhea will persist on consuming any of them.

- **Sucrose intolerance (Rare):** As lactose intolerance but the involved enzyme is invertase so diarrhea will persist on consuming sucrose containing milk e.g. Bebelac LF, Dialac FL.
- **Cow's milk protein allergy:** Diarrhea occurs due to cow's milk protein intolerance, improved on withdrawal of cow's milk from diet.

☆ **Risk factors:**

- 1- Young age of the child (esp. < 18 months old).
- 2- ↓ healing of the villi esp. in:
 - Malnutrition.
 - Measles infection.
 - Immune-deficiency.
 - Vit. A deficiency.
- 3- Prolonged antibiotic therapy.
- 4- Recurrent diarrhea especially recent attack.
- 5- Recent introduction of animal milk or formula.

☆ **Investigations:**

- 1- Stool analysis: for giardia, amoeba, ...
- 2- Stool culture: for bacteria.
- 3- Stool pH and reducing substances: for carbohydrate intolerance (↓ pH).

☆ **D.D:**

Must be differentiated from chronic diarrhea and malabsorption syndrome.

☆ **Management:**

- 1- Good hydration according to the degree of fluid loss.
- 2- Good nutrition during the attack, better to avoid cow's milk. Feeding is better given in small frequent feeds with adequate caloric intake and supplementation of minerals & vitamins esp... Iron, Zinc, Vit. A and D.
- 3- TTT of the cause.
 - Anti parasitic for giardiasis.
 - Antibiotic for shigella.
 - Short time stoppage of milk and substitution with lactose free formula (Bebelac LF) in cases of lactose intolerance until regeneration of the villi occurs.

IV- CHRONIC DIARRHEA

☆ Definition:

Diarrhea of gradual onset with recurrent or long standing course mostly persists more than one month.

☆ Mechanism of ch. diarrhea:

1- Secretory diarrhea:

(See before) especially with persistent infective agents e.g. shigella & Rota virus.

2- Osmotic diarrhea:

(See before) especially with lactose intolerance with continuing feeding of lactose containing milk.

3- Reduction of intestinal surface area:

Any cause which lead to ↓ intestinal size (e.g. short gut syndrome) or lead to villous atrophy (e.g. Coeliac disease) this ↓↓ surface of the intestine → ↓ absorptive and digestive functions → loss of fluids, nutrient; and minerals → chronic diarrhea.

4- Change in intestinal motility:

Malnutrition, DM and others may ↓ intestinal motility → stasis of intestinal contents → bacterial overgrowth and deconjugation of bile salts → injury to mucosa → diarrhea.

☆ Aetiology:

1- Malabsorption syndrome: All causes of malabsorption syndrome may lead to chronic diarrhea "See later".

2- Metabolic causes: Galactosaemia, Gaucher's disease, Tyrosinaemia.

3- Endocrinal: e.g. Hypoparathyroidism and Hyperthyroidism.

4- Chronic non specific diarrhea (Toddler's diarrhea): Type of chronic diarrhea occurs in infants with no obvious cause, diagnosed by exclusion. mild, infrequent without associated dehydration or malnutrition.

☆ Diagnosis of a case of chronic diarrhea :

1- Diagnosis of malabsorption syndrome "See later".

2- Diagnosis of metabolic disorders.

If suspected, metabolic screen may be done e.g. reducing substances in urine, specific enzyme deficiency.

3- Diagnosis of endocrinal disorders:

Manifestations and investigations of thyroid and parathyroid abnormalities.

4- Chronic non specific diarrhea: Diagnosed by exclusion of other causes.

☆ Management of chronic diarrhea:

1- Treatment of malabsorption syndrome.

2- Treatment of metabolic and endocrinal disorders.

3- Nutritional support for chronic non specific diarrhea until spontaneous resolution.

MALABSORPTION SYNDROME

☆ Definition:

"Defective absorption of nutrients from GIT".

Steatorrhea means fat malabsorption but in fact it is used to describe all causes of malabsorption.

☆ Causes:

I- Defective digestion:

- Pancreatic causes: Cystic fibrosis, pancreatitis and long standing PEM
- Biliary causes: Biliary atresia.

II- Intestinal stasis:

- PEM
- Inflammatory bowel disease (Crohn's and ulcerative colitis).

III- Defective intestinal absorption:

1- Generalized malabsorption:

- Chronic infection (Giardia, Bilharziasis, T.B.)
- Celiac disease.
- Intestinal tumours
- Anatomical defects (e.g. short gut syndrome).

2- Specific malabsorption:

- Specific vitamin malabsorption (e.g. ↓ B12 → pernicious anemia)
- Specific mineral malabsorption (e.g. ↓ Zinc → acrodermatitis enteropathica)
- Specific CHO malabsorption (e.g. Lactose intolerance)
- Specific fat malabsorption (e.g. Abeta lipoproteinaemia).
- Specific A.A. malabsorption (e.g. Enterokinase enz. ↓↓)

☆ Clinical manifestations:

1- Manifestations of the cause.

2- General ill health (weakness, pallor, failure to thrive).

3- GIT manifestations:

- Mouth ulceration and glossitis.
- Steatorrhea (Pale, bulky, greasy, offensive stool).
- Abdominal distention and flatulence
- Chronic diarrhea.

4- Manifestations of nutrients deficiency:

- CHO → hypoglycaemia and failure to thrive.
- Fat → subcutaneous fat loss.
- Ptn. → muscle wasting, loss of weight ± oedema.
- Vitamins and minerals deficiency.

☆ **Investigations:**

I- To prove malabsorption:

- **Stool analysis:** Fat contents, parasites, pH & reducing substances.
- **Others:** Xylose absorption test, bile salt breath test.

II- For the cause:

- X-ray barium swallow for stricture and narrowing
- Abdominal ultrasound for masses.
- GIT endoscopy with intestinal biopsy.
- Sweat test for cystic fibrosis.

☆ **Treatment:**

- 1- Treatment of the cause including surgical interference for surgical problems.
- 2- Supplementation of deficient nutrients.
- 3- Fat soluble vitamins are given parenterally with substitution of fat with medium chain triglycerides in cases of fat malabsorption.

COELIAC DISEASE

Familial disease ($\pm$ AD) characterized by permanent intestinal intolerance to gliadin fraction of gluten which present mainly in wheat and rye leading to severe intestinal mucosal lesions $\rightarrow$ so called (Gluten - sensitive enteropathy).

☆ **Aetiology:**

3 Factors are responsible: Genetic, environmental and toxicity of gliadin.

☆ **Clinically:**

- 1- Manifestations of malabsorption syndrome esp. steatorrhea and chronic diarrhea with complete resolution after elimination of gluten from diet for few days.
- 2- Long standing $\rightarrow$ finger clubbing and failure to thrive.
- 3- Coeliac disease may be associated with: IDDM, Malignant changes in GIT & Selective IgA deficiency.

☆ **Investigations:**

- ⊗ Clinical diagnosis esp. therapeutic response to gluten free diet is suggestive.
- ⊗ Also elevated serum antibodies (anti gliadin, antiendomysial & antitissue transglutaminase) may be helpful.
- ⊗ However the definitive diagnosis is jejunal biopsy that shows characteristic (flat mucosal lesions with villous atrophy).

☆ **Treatment:**

- ⊗ **Gluten free diet for life:** (elimination of wheat, rye & barley from diet and substitution with maize and rice).
- ⊗ **Treatment of associated disorders.**

CYSTIC FIBROSIS

CF is inherited as an AR trait. CF is caused by a mutation in the gene for the protein cystic fibrosis transmembrane conductance regulator (CFTR). This gene is required to regulate the components of sweat, digestive juices, and mucus.

★Clinical presentations:

- a- Meconium ileus in the newborn.
- b- Recurrent chest infections , bronchiectasis.
- c- Nasal polyps, sinus disease.
- d- Malabsorption syndrome.
- e- Clubbing , failure to thrive.
- f- DM: may develop later on.
- g- Increased liability for dehydration

★Investigations:

- a- The newborn screen initially measures for raised blood concentration of immunoreactive trypsinogen.
- b- Sweat chloride test
- c- Mutation analysis (the most common is $\Delta F508$).

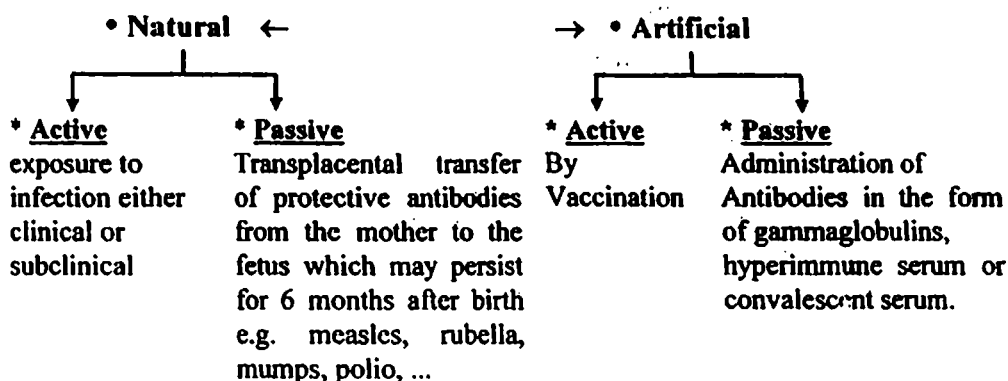
★Treatment:

- The cornerstones of management are treatment of airway infection, and encouragement of good nutrition and an active lifestyle.
- Pancreatic enzyme replacement, and supplementary vitamins.
- Gene therapy : aims to introduce normal CFTR to airway.

CHAPTER (VI)

IMMUNIZATION

Types of Immunity



Passive Immunization

① Prevention by antitoxins:

- Organisms which produce their pathogenic effect by toxin production can be prevented by antitoxin administration.

• Examples:

Diphtheria: 3000- 5000 units of diphtheria antitoxin is given I.M. to non immunized or irregularly immunized child when exposed to a patient with diphtheria.

Tetanus: 3000-5000 units of tetanus antitoxin is given I.M. after injury in a park or street if the child immune status is unknown or had less than 3 doses of DPT.

• Precautions:

As antitoxins are animal sera, allergy may present so:

- ◊ History of sensitization is important.
- ◊ Concomitant use of corticosteroids may be advisable.
- ◊ If allergy occurs, corticosteroids and adrenaline should be given immediately.

② Prevention by antibodies:

A lot of diseases are infectious so, if household contacts of the case were not previously immunized they may catch the disease, in these situations administration of immunoglobulins may decrease the risk of disease transmission.

• e.g. Hepatitis A, Hepatitis B, Measles, Varicella Zoster and Tetanus (given I.M).

• N.B.: Tetanus immunoglobulin is more safe than tetanus antitoxin in prevention of tetanus.

Active Immunization

Active immunization can be achieved by vaccine administration, some vaccines are regularly used for all children at certain ages so called compulsory vaccinations, other vaccines are given only to special groups or in special circumstances and called "Non compulsory vaccinations"

Compulsory "Schedule" Vaccines

	against T.B. (BCG)	Against polio (Sabin) oral	(DPT)	(Hepatitis B)	(Measles)
Nature:	Live attenuated vaccine prepared from special strains of bovine T.B. (Bacillus Calmett and Guérin)	Live attenuated viral vaccine.	Diphtheria and tetanus toxoids and heat killed pertussis organism	Non infectious unit related to HBs Ag prepared by recombinant DNA technique.	Live attenuated vaccine.
Dose & Route	- 0.05 ml for neonates & 0.1 ml for older individuals intradermal in left upper arm.	- 2 drops oral	- 0.5 ml I.M.	- 0.5 ml below 10 yrs & 1ml above 10 yrs. - I.M. in anterior part of the thigh & in deltoid for older children. - Not effective in the buttocks.	- 0.5 ml S.C.
1st doses	- In the 1 st 2 months	- 2,4,6 months	- 2,4,6 months	- 2,4,6 months (birth, 1 & 6 in some countries)	- 9-15 months single dose Now in Egypt MMR is only given
- Booster doses	- May be given only to tuberculin -ve reactors at the beginning of every school period.	- 18 months - 4 years. (frequent doses are recommended and have no hazards)	- 18 months. - 4 years. - DT only after that (school age)	- Not needed.	- Not needed but may be given every new school period. (Not in Egypt).
Reaction	1- Small papule is formed gradually forms crust, which disappears in 8-12 weeks. 2- Local abscess may result. - In both cases permanent scar is left	#	* Minor reaction. - local tenderness. - slight fever. * Moderate reaction - Irritability. - Shock like syndrome * Severe reaction. - Simple convulsions. - Rarely encephalitis	- Local reaction at the site of injection. —	- Faint skin rash may develop 1-2 weeks after vaccine & lasts for 2-3 days.

Complication	BCG	Polio (sabin)	DPT	Hepatitis B	Measles
	*Regional LN enlargement (required INH treatment). *Disseminated T.B. if given to immunocompromized child	Failure of Vaccination may result from. 1- Bad refrigeration. 2- Vomiting or diarrhea. 3- Breast feeding 2 hours before or after vaccination. 4- No booster doses.	Severe forms of the previous Reactions N.B.: Diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine has a lower incidence of complications	Failure of vaccination: - Bad vaccine storage. - Injection in the buttocks. - Immunocompromized patient.	Encephalitis
Contra-indications	General+	General+	General+	General+	General+
<u>General C.I.:</u> 1- Acute febrile illness 2- Debilitating diseases and convalescence from diseases. 3- Immuno-deficiency or intake of immunosuppressive drugs. 4- Pregnancy in live vaccines	5- Tuberculin +ve reactors.	5- Diarrheal or vomiting disorders	5- Previous occurrence of severe reactions - fever > 40. - Shock like syndrome. - Neurological reaction. (Better to remove pertussis and give DT as pertussis is the commonest cause of such reactions).	5- Hypersensitivity to any vaccine component	5- Anaphylactic reaction to egg.
N.B:	BCG vaccine causes +ve tuberculin test so ↓ the importance of tuberculin test in diagnosis of T.B. (false +ve results)	Parenteral Trivalent polio Vaccine (salk Vaccine) is given in some countries at the same timing but oral is recommended than parenteral: - Easily administrated. - Low cost. - Pass in stool so helps polio eradication from community. - Gives both humoral and cell mediated immunity. (salk gives humoral only)		Infants to HBS Ag +ve mothers are given 0.5 ml hepatitis B immunoglobulin at birth & the 1st dose of vaccine in other site. The other doses of the vaccine are given at 1 & 6 months.	- MMR vaccine is a live attenuated vaccine given at 12 months (S.C.) and another dose may be given at 18 months. - Reaction: local pain & joint stiffness. - Complications and contraindication as measles

Non compulsory vaccines

Disease	Preparation	Route & timing	Problems
- Haemophilus Influenza type B (Hib)	- Prepared as non infectious capsular antigenic part	<i>I.M.</i> at 2,4,6 months Booster dose at 15 months	- Low grade fever - Local reaction - Hyper-sensitivity.
pneumococcal conjugate vaccine (prevenar) (PCV7)	-Pneumococcal polysaccharides conjugated to a nontoxic form of diphtheria toxin	- As Hib	- As Hib.
Pneumococcal polysaccharide vaccine (23 valent) (PPS23)	Pneumococcal polysaccharides	- single IM dose after 2 years of age.	- As Hib.
Rota virus vaccine a- Rotarix	live attenuated rotavirus vaccine	2 oral doses 4 weeks apart	the second dose should not be given after the 6th month for fear of intussusceptions.
b- RotaTeg	oral pentavalent vaccine	3 oral doses	3rd dose at 32 weeks
- Influenza	- Inactivated viral vaccine type A,B prevalence for the year.	<i>I.M.</i> 2 doses (1 month interval)	- Fever - Myalgia. - Guillian Barre syndrome. - Hypersensitivity.
- Hepatitis A (Haverix)	- Inactivated	<i>I.M.</i> 2 doses (6 months interval)	- Mild local reaction
- Meningococcal meningitis (Mencevax)	- As Hib in many types (A,AC,C or ACYW135)	<i>S.C.</i> single dose	- Short period of efficacy ($\pm$ 2 years)
- Cholera (Koll's)	- Inactivated	<i>S.C.</i> 2 doses (1 month interval)	- Weak protection (50-70%) for 6 months only
- Typhoid → TAB	→ Inactivated →	<i>S.C.</i> single dose	→ 50% protection
→ Ty21a	→ Live attenuated →	<i>Oral</i> single dose	→ 70% protection
- Yellow fever (17D vaccine)	- Live attenuated	<i>S.C.</i> single dose	- Fever - Myalgia. - C.I. in anaphylactic reaction to egg.
- Chicken Pox	- Live attenuated	<i>S.C.</i> single (< 12 yrs). 2 doses (> 12 yrs)	- Mild local reaction

- Others $\Rightarrow$ Plague, Rota Virus, Respiratory Syncytial Virus and Rabies.



After animal bite:

- 1- Passive immunization HRIG (Rabuman) 20 IU/Kg half the dose local and half of the dose I.M.
- 2- Active immunization either:
 - Human Diploid cell vaccine (days $\rightarrow$ 0, 3, 7, 14, 28) I.M.
 - or - New Duck Embryo vaccine (days $\rightarrow$ 0, 3, 7, 14, 28, 90) S.C.

• General indications of non compulsory vaccines:

- High risk groups.
- Household contacts to a case.
- During epidemics.
- Travelers to endemic areas.
- Before splenectomy (Hib., pneumococcal & meningococcal vaccines).

CHAPTER (VII)

INFECTIOUS DISEASES

- | | | |
|---------------------|----------------------------------|------------------------|
| * Viral: | A) <u>With rash</u> "exanthemes" | B) <u>Without rash</u> |
| * Bacterial: | C) <u>Gram +ve</u> | D) <u>Gram -ve</u> |
| * Parasites: | E) <u>Helminthes</u> | F) <u>Protozoa</u> |

INCUBATION PERIOD

- | * <u>Very long</u> | * <u>2-3 weeks</u> | * <u>1-2 weeks</u> | * <u>Short (< 1 week)</u> |
|--------------------|--------------------|------------------------|------------------------------|
| • TB | • Rubella | • Measles | • Diphtheria |
| • IMN | • Mumps | • Variola | • Scarlet fever |
| • Rabies | • Varicella | • Roseola infantum | • Influenza |
| • Leprosy | | • Erythema infectiosum | • Cholera |
| • Viral hepatitis | | • Poliomyelitis | • Common cold |
| | | • Pertussis | • Cerebrospinal meningitis |
| | | • Typhoid | |
| | | • Tetanus | |

☞ *N.B.*

- 1- All viral infections have long incubation period except influenza.
- 2- Most infections occur at winter and spring.
- 3- Haemophilus influenza is a serious gram -ve bacteria of 2 types (A) and (B), type B is the most severe.

H. influenza can produce the following in Pediatrics:

- Meningitis (64%)
- Acute epiglottitis (7%)
- Pneumonia (7%)
- Septic arthritis (7%)
- Bacteraemia (7%)
- Others (Cellulitis, pericarditis, endocarditis, osteomyelitis).

☆ H. influenza is best treated by 3rd generation cephalosporins esp. ceftriaxone and cefotaxime, amoxycillin and co-trimoxazole may be effective in non-resistant strains.

A- Viral Diseases associated with rash

	Measles "Rubeola"	German measles "Rubella"	Roseola infantum "6th disease"	Erythema infectiosum "5th disease"	Chicken Pox "Varicella"
* Pathogenesis: • Cause ⇒	⇒ RNA virus of Paramyxo group, only one antigenic type so infection is followed by life long immunity.	⇒ RNA virus of Myxovirus group, one attack is followed by life long immunity.	⇒ Human herpesvirus type 6 (DNA).	⇒ Human parvovirus B19 (DNA).	⇒ Varicella - Zoster virus (DNA) which causes varicella in children and Herpes Zoster if reactivated in adults
• Route ⇒	- Direct droplet. - Air born infection. - Contaminated articles and fomites	- As measles - Transplacental from infected mother to foetus	- As measles	- As measles	- As measles - Contact of lesions (before crusts)
• Reservoir ⇒	- Cases - No carrier state	- Cases - Incubatory carriers	- Cases - Carriers	- Cases - Carriers	- Cases of varicella or herpes Zoster. - No carrier state
• Incubation P. ⇔	10-12 days	14-21 days	5-14 days	5-14 days	21 days
• Infectivity period ⇒	⇒ 5 days before and 5 days after rash appearance	⇒ 7 days before and 7 days after rash appearance.	⇒ Variable	⇒ Variable	⇒ 2 days before rash appears till all lesions crusted.
* Epidemiology:	- Endemic all over the world. - (Age) → late childhood	- Endemic all over the world. - (Age) → late childhood dangerous if occur in the 1st trimester of pregnancy.	- Commonly occurs in epidemics - (Age) → common in infancy and < 3 yrs..	- Commonly occurs in epidemics - (Age) → common in late childhood.	- Endemic all over the world - (Age) → common in late childhood

	Measles "Rubeola"	German measles "Rubella"	Roseola infantum "6 th disease"	Erythema infectiosum "5 th disease"	Chicken Pox "Varicella"
★ <u>C/P:</u>	<u>Prodroma:</u> 3-4 days - ↑ fever, conjunctivitis, photophobia, coryza & cough. - Koplik's spots "pathognomonic" appears at the 3rd day of fever as greyish white dots with reddish areolae opposite the lower molar teeth disappear 1-2 days after appearance of rash. <u>Eruption</u> - Maculopapular rash appears on the 4th to 5th day of fever with ↑↑ fever for 2 days then rapidly falls (by lysis). - Rash start behind the ear, near the hair line then face and neck then trunk and arms. - When reaching L.L. (3rd day) it begins to fade from the face.	<u>Prodroma:</u> 1 day - Mild, short ± absent - Slight fever, nasopharyngitis, tender enlargement of L.N. (Post auricular, post cervical & occipital) - Rose spots: discrete, may appear on the palate just before appearance of skin rash. <u>Eruption</u> - Maculopapular rash appears on the 2nd day of fever. Fever subsides by rash appearance. - 1st started on the face then spread to trunk and lower extremities within the same day. - Rash is rapidly evolved, by the time it spreads to the trunk it fades from the face.	<u>Prodroma:</u> 3-4 days - Sudden ↑↑ fever (39°-41°) ± convulsions. - No physical findings explaining this high fever. - Fever falls by crises at the 3rd to the 4th day. <u>Eruption</u> - Maculopapular rash appears in 3rd or 4th day of fever. - Starts on trunk then neck, arms with slight face and L.L. involvement & rapidly fades in 1-2 days.	<u>Prodroma:</u> - Usually absent or very mild. <u>Eruption</u> 1- Sudden appearance of livid erythema of the cheek (slapped cheek). 2- Maculopapular pruritic rash on trunk & extremities. 3- Rash fades with central clearing (reticulated appearance).	<u>Prodroma:</u> ± 1 day - Mild prodroma in the form of slight fever, anorexia, malaise, <u>Eruption</u> - Begins on the 2nd day of fever on the trunk then face and scalp with slight involvement of the extremities (centripetal). - Begins as small red papules → vesicles → pustules → crusts - Ulceration of m.m. and vesicles are common - Lesions are itchy, hgc & pleomorphic.

	Measles "Rubeola"	German measles "Rubella"	Roscola infantum "6th disease"	Erythema infectiosum "5th disease"	Chicken Pox "Varicella"
	Convalescence: - Rash fades in order of appearance within 3 days leaving fine branny desquamation and may leave pigmented areas (- 3 days prodroma - 3 days rash - 3 days rash fading)	Convalescence: - Rash usually clears on the 3rd day with little or no desquamation - Called 3 days measles: (-1 day prodroma - 1 day rash - 1 day rash fading)	Convalescence: - Rash rapidly fades without desquamation	Convalescence: - Rash lasts from 2- 39 days (mainly 11) and fades without desquamation	Convalescence: The acute phase of illness usually lasts about 1 week. Complete resolution is the rule but may be fatal in immunocompromized children
Clinical variants "types"	1- <u>Very mild</u> → Rash does not reach the legs. 2- <u>Classic form</u> → As usual. 3- <u>Severe form</u> → Rash confluent and covers the skin completely → swollen disfigured face. 4- <u>Hgic form</u> → Hgic rash & Bleeding.	1- <u>Ordinary Type</u> 2- <u>Congenital Rubella syndrome</u> - Incid: 20% of infants to mother with rubella. - Aet: Maternal infection esp. in the 1st trimester.			1- <u>Very mild:</u> few lesions. 2- <u>Classic form:</u> As usual. 3- <u>Severe form:</u> severe lesions and ↑ fever 4- <u>Hgic form:</u> Hgic rash & bleeding esp. in immunodeficient. 5- <u>Congenital varicella:</u> at birth or 1st few days if the mother is infected.

	Measles "Rubeola"	German measles "Rubella"	Roseola infantum "6th disease"	Erythema infectiosum "5th disease"	Chicken Pox "Varicella"
* Compl-ications: Resp. CNS GIT CVS Blood Others	1- Respiratory: a- Otitis media, sinusitis. b- Tonsillo-pharyngitis & cervical adenitis. c- Laryngitis with stridor (measles croup), trachitis & bronchitis. d- Activation of T.B. focus but with false -ve tuberculin is common. e- Pneumonia: which may be * Viral: by measles virus (early, severe) * Bacterial: by 2ry infection (late, mild) * Giant cell (Hecht's) pneumonia: Caused by measles virus and chch by multinucleated cells in the lungs esp. in immunocompromized. 2- Neurological a- Encephalitis b- Aseptic meningitis c- Guillian Barre syndrome d- Subacute sclerosing panencephalitis (rare, progressive degeneration of CNS occurs years after 1ry measles infection) 3- GIT a- Ulcerative stomatitis b- Gastroenteritis. c- Enterocolitis. 4- CVS: - Myocarditis. 5- Hematological - Purpura, Hgic rash & Bleeding 6- Others: - Corneal ulcers and 2ry bacterial conjunctivitis.	1- General complications: Rare and mild neuritis or arthritis 2- Congenital rubella syndrome.	- Very rare including respiratory lesions in immuno-comprimized patients only.	- Very rare including hepatitis and penumonitis - Predispose to aplastic crises in patients with hemolytic anaemia.	1- Respiratory: - Varicella pneumonia - Laryngitis up to R.D. 2- Neurological: - Postinfectious encephalitis → cerebellar ataxia - Convulsions, coma. - Rye syndrome esp. with aspirin intake. 3- GIT: - Hepatitis 4- CVS: - Myocarditis. - Pericarditis. - Endocarditis 5- Haematological: - Thrombocytopenia with hge. - Purpura fulminans (extensive purpura associated with gangrene). 6- Others: - 2ry bacterial skin infections esp. with streptococci.

	Measles "Rubella"	German measles "Rubella"	Roseola infantum "6th disease"	Erythema infectiosum "5th disease"	Chicken Pox "Varicella"
● Management	I - Of the patient: 1- Isolation during infectivity. 2- Bed rest + light diet. 3- Symptomatic tt (fever, cough.) 4- Antibiotics in 2ry infection. 5- Antiviral tt only in immuno-compromized. N.B.: Recently, vit. A is suggested to ↓ morbidity & mortality of severe measles II- Of the contacts: 1- Isolation and observation for the incubation period. 2- Passive immunization: Immune serum globulin 0.25 ml/kg/I.M.: - <u>If given < 6 days of exposure</u> "Sero prevention" No disease but no immunity will be acquired so measles vaccine will be needed (2 months later) - <u>If given after 6 days of exposure</u> "Seroattenuation" Mild disease followed by life long immunity.	I- Of the patient: - Symptomatic tt except pregnant female if catch the disease in the first trimester which needs: * Abortion if accepted. * ISG (20-30 ml I.M.) if the mother refuses abortion (doubtful) II- Of the contact: 1- Children → Isolation except young unmarried female (give her the disease). 2- Married non pregnant female → vaccination against Rubella with no pregnancy for 3 months. 3- Pregnant female → Isolation, test her immunity by haemagglutination inhibition test (HI test) * If immune ⇒ continue pregnancy * If non immune ⇒ - Abortion if accepted. - ISG (20-30 ml I.M.) if the mother refuses abortion (doubtful) (Better avoid ISG) N.B. ISG = immune serum globuline	- Symptomatic tt only - No Isolation	- Symptomatic tt only - No Isolation	I- Of the patient: As measles + Strong antihistaminic + avoid aspirin. Why? +Antiviral: Acyclovir: 20 mg/kg/dose given 4 doses per day for 5 days, in complicated cases or immunocompromise d child. II- Of the contact: 1- Isolation for the incubation period. 2- Zoster-immunoglobulin (ZIG) is given to child at risk of having severe varicella e.g. child with leukaemia or immunodeficiency.

* Small Pox:

- * **Aet:** DNA virus from Pox group eradicated from the world (1978).
- * **C/P:**
 - Prodroma: 3-4 days of ↑ fever, headache,
 - Eruption: * macules → papules → vesicle → pustules
→ scales which leaves permanent scars.
 - * The rash begin in extremities (centrifugal)
- * **Complications:**
 - * Bronchopneumonia
 - * Skin infection.
 - * Encephalitis
 - * Osteomyelitis
- * **Management:**
 - Prevention: by vaccine (which was compulsory till eradication).
 - TTT: supportive.

* Infectious mononucleosis:

- * **Pathogenesis:**
 - Aetiology: Epstein Barr virus → (DNA virus) infection occurs by droplet infection and rarely blood born.
 - Incubation period: 1-2 months
 - Infectivity: Throughout the course of the disease.
 - Epidemiology:
 - World wide endemic disease with small outbreaks
 - Occurs in all ages but common below 3 years age.
- * **Manifestations:**
 - ① **Prodroma** of 1-2 weeks of headache, fever, anorexia, vomiting, rash appears in 15% of cases (80% if ampicillin is administered).
 - ② **Full picture consists of:**
 - Tonsillopharyngitis • Lymphadenopathy. • Splenomegaly ± hepatomegaly
 - ③ **Manifestations lasts from** 2-4 weeks then slowly disappear.
- * **Investigations:**
 - Atypical lymphocytosis • +ve Paul Bunnell and Monospot tests. • ↑ IgM titer
- * **Complications:**
 - 1- **Respiratory:** → Pneumonia and URT obstruction (swollen tonsils)
 - 2- **Neurological:** → As measles
 - 3- **GIT:** → Rupture spleen (esp. during the 2nd week).
 - 4- **CVS:** Myocarditis.
 - 5- **Hematological:** → Hemolytic anaemia, aplastic anaemia or thrombocytopenia
 - 6- **Oncogenicity:** → e.g. lymphomas.
- * **Treatment:**
 - Symptomatic ttt
 - Steroids are used in URT obstruction, meningitis and immune complications.

N.B. Types of skin lesions:

• **Primary lesions**

- 1- **Macules** → altered skin colour not elevated
- 2- **Papules** → elevated solid lesions < 1cm
- 3- **Nodules** → elevated solid lesions > 1cm
- 4- **Vesicles** → elevated fluid filled lesions < 1cm.
- 5- **Bullae** → elevated fluid filled lesions > 1cm
- 6- **Pustules** → as (4) or (5) but the fluid is purulent.
- 7- **Plaques** → aggregation of any 1ry lesions.

• **Secondary lesions**

- 1- **Scales**: compressed layers of stratum corneum on skin surface.
- 2- **Ulcers**: excavatum of necrotic tissues
- 3- **Fissures**: cracking of skin.
- 4- **Crusts**: retained accumulated pus, sebum and epithelial debris on skin surface.
- 5- **Scars**: end stage lesions composed of fibrous connective tissue.

*** Differential diagnosis of maculo-popular rash:**

	• Clinical data	• Eruption "Rash"	• Investigations
• Measles	- Conjunctivitis, photophobia, koplik's spots in the prodroma. - Rise of temp after rash appearance	- Rash occurs at the 5th day of fever begins near the ear and post. hair line - Branny desquamation	- Isolation of the virus - ↑ antibody titre
• Rubella	- Short mild prodroma - Palatal exanthemes - Lymph node ++	- Rash appears on the 2nd day followed by ↓↓ fever	- The same
• Roseola infantum	- Abrupt rise of temperature without supportive findings	- Rash appears on the 4th day with drop of fever by crises	- The same.
• Erythema infectiosum	- Absent prodrom with chch reticulated appearance	- Rash appears on the trunk and may last for long period.	- The same.
• I.M.N.	- Lymphadenopathy - Sore throat. - ± Hepatosplenomegaly	- 15% spontaneous - 80% if ampicillin is administered	- Atypical lymphocytes - Paul Bunnell and Mono spot tests
• Enterovirus and Adenovirus infection	- Mild constitutional manifestations	- Mild eruption	- Isolation of the virus - ↑ antibody titre
• Scarlet fever	- Tongue → white then red strawberry - Circumoral pallor	- Rash appears on the 2nd day of fever	- Schultz Charlton - Throat culture - Leukocytosis
• Meningococcal septicemia	- Marked toxemia - Absent cough.	- Acute purpuric eruption ± gangrene	- + ve blood culture ± CSF
• Serum sickness and drug eruption	- No prodroma, no cough - History of drug intake	- More rash on the extremities with pruritis	
• Purpura	- May occur with bleeding, ± organomegaly, according to the cause	- Macular rash doesn't fade on pressure	- Platelet count - Bleeding time
• Flea bites (Insect bites)	- Itching. - Insect may be seen	- Vasodilatation of cutaneous blood vessels which fade on pressure	

* Differential diagnosis of papulovesicular rash:

1) Viral:

a - Chicken pox

Skin rash:

- Begins as crops of red papules (within hours) then becomes clear teardrop vesicles (within hours) then became cloudy.
- The vesicles are easily broken and become scabbed forming pustules or crusts
- Pleomorphic rash: within two days, mixed rash is present (papules, vesicles, pustules, crusts).
- Centripetal: Affects trunk and face mainly
- Rash is itchy.
- Fever occurs when there is extensive rash or pustular infection

b - Herpes simplex:

Multiple small vesicles usually over the lips, oral cavity and usually follow upper respiratory tract viral infection

c - Herpes zoster :

It follows a dermatomal distribution, strictly unilateral with burning pain.

d - Coxsackie virus Hand foot and mouth disease.

e - Small pox : monomorphic, centrifugal, high mortality and complicated with scarring.

2) Bacterial: - Impetigo contagiosum

Characterized by marked infectivity, vesicles crust formation and usually occur in the face and hands

3) Fungal e.g. Tinea circinata which has an active spreading edge.

4) Insect bite

5) Atopic dermatitis: itchy popular and vesicular lesions mainly on upper and lower limbs.

B- Viral infections without skin rash

MUMPS*** Pathogenesis:**

- ♦ **Cause:** RNA virus paramyxogroup affecting the salivary glands
- ♦ **Route:** As measles
- ♦ **Reservoir:** Human cases, no carriers, no animal reservoirs.
- ♦ **Incubation P.:** 2-3 weeks.
- ♦ **Infectivity P.:** Virus can be isolated from saliva 6 days before and 9 days after appearance of swellings but true infectivity may be 1 day before and 5 days after.

*** Epidemiology:**

- Endemic in most urban population and epidemics may occur especially in winter, one attack → life long immunity.
- (Age) → late childhood

*** C/P:**♦ **Prodroma**

- Usually absent, if present it will be mild for short duration (1-2 days).
- Consists of fever, headache, myalgia, malaise.

♦ **Salivary gland swelling:** ⇒ Usually parotid ± submaxillary and sublingual**1- Parotid swelling:**

- Starts by filling the space between the posterior border of the mandible and the mastoid then extends downward and forward,
- The swelling pushes the ear upward and outward.
- The swelling is prominent in clenching the teeth and disappears on mouth opening.
- The swelling reaches its maximum size within 3 days and subsides within 5 days.
- Sometimes painful and tender.
- Usually the swelling of one gland precedes the other by 1-2 days but unilateral swelling occurs in 30% of cases.

2- Submandibular swelling:

- May accompany or rapidly follows parotid and 10-12% alone.
- Pain is less than parotid.
- Takes more time to subside than parotid.

3- Sublingual swelling:

- Submental swelling, usually bilateral.
- The least common gland involvement in mumps.

*** Differential Diagnosis:** SAMUEL

- ① **Stone (Parotid stone):** • Pain ↑ by mastication
• Felt under the skin or seen in X-ray..
- ② **Abscess (suppuration):** • ↑↑ constitutional symptoms.
• Pus may ooze from parotid duct.
- ③ **Miculicz syndrome:** • Simultaneous enlargement of lacrimal and parotid glands.

- ④ **Uveal parotid fever:** • Parotitis & Iridocyclitis (esp. in sarcoidosis)
- ⑤ **Endemic parotitis:** • Bilateral painless swelling (due to chronic anaemia, malnutrition and ankylostoma)
- ⑥ **Lymphadenopathy:** • Upper cervical L.N. enlargement

*** Complications:**

♦ **Common complications:**

	1- Meningoencephalomyelitis	1- Orchitis and Epididymitis	3- Oophoritis	4- Pancreatitis
• Incidence	- Most common childhood complications - Boys > girls	- Common in adolescents and adults (20 %), rare prepubertal	- Common in post pubertal girls (7%)	- Relatively common in children
• Diagnosis	- Fever, headache, vomiting ± convulsions. - May precede, accompany or follow parotitis (even without)	- Usually unilateral - Testis becomes tender, red, swollen and hot.	- Mild pelvic pain and tenderness	- Epigastric pain, fever & vomiting - May occur without salivary involvement so may be misdiagnosed as G.E.
• Prognosis	- Responds to symptomatic ttt in most cases	- Impairment of fertility may occur but absolute infertility is very rare	- No evidence of impairment of fertility	- Responds to symptomatic ttt (IV fluids and analgesics)

♦ **Rare complications:**

5- **Ocular:**

- **Dacryoadenitis:** Painful swelling of the lacrimal gland.
- **Optic neuritis:** Varies from blurring of vision up to visual loss (rare).
- **Uveokeratitis:** Unilateral photophobia with tearing.
- **Scleritis, central vein thrombosis:** Very rare

6- **Deafness:**

- Unilateral (rarely bilateral) nerve deafness.
- Transient hearing loss (permanent in < 0.1% of cases of mumps).

7- **Thyroiditis:** • Diffuse tenderness one week after parotitis.

8- **Myocarditis:** • Rare and mild with depressed ST segment on ECG.

9- **Thrombocytopenia:** with purpura.

10- **Mumps Embryopathy:** Mumps in early pregnancy may ↑ incidence of abortion and may be related to the development of endocardial fibroelastosis in the baby.

*** Investigations:**

- Mumps is a clinically diagnosed, investigations are not needed, however in doubtful cases viral culture and rise of serum amylase may be helpful(serum lipase is more specific).

*** Management:**

I- **Prophylaxis:** Live attenuated viral vaccine which is included in MMR vaccine.

II- **TTT of the patient:**

1- Bed rest, adequate diet, analgesics.

2- TTT of complications: e.g. supportive care for meningoencephalitis; local support for orchitis.

III- **Measures for the contact:**

- Passive hyperimmune mumps γ -globulin is available but not effective in preventing mumps or decreasing incidence of complications.

- Isolation may not be beneficial as the disease is contagious before appearance of the swelling.

POLIOMYELITIS*** Pathogenesis:**

- ❖ **Cause:**
 - Small RNA virus with 3 serotypes (I, II, III).
 - No cross immunity between the 3 serotypes so other attack may occur (but very rare)

- ❖ **Route:**

- **Oropharyngeal route** → Droplet → Tonsils → Local L.N.
→ Feco-oral → Intestine → Intestinal L.N.

Then the virus reaches the CNS either by direct spread along the nerve filaments or by haematological spread.

- ❖ **Incubation period:** 1-3 weeks.

- ❖ **Reservoir:** Man is the main reservoir for infection.

*** Epidemiology:**

- ❖ The disease was endemic worldwide with epidemics, now, the incidence of polio is much lower and a lot of countries eradicated polio completely. WHO hoped that by 2005 polio would be completely eradicated world wide. Unfortunately this did not achieved; however no cases were reported in Egypt since 2004.

- ❖ There is marked discrepancy between the incidence of infection and the incidence of disease (i.e. the incidence of the disease is only 1:10.000 of those infected). The occurrence of the disease depends on:

1- **Neurovirulence of the causative virus:**

Type I is the most severe, type II is the least virulent and type III is intermediate.

2- **Host factors:**

- Advanced age and pregnancy ↑↑ severity of the disease.
- Excessive muscular activity in a recently infected person (e.g. Intramuscular injections, trauma, surgical procedures or vaccination esp. DPT) ↑ severity.
- Recent tonsillectomy may predispose to bulbar polio.
- Previous exposure to the virus or the vaccine will ↑↑ the immunity against polio.

*** Pathology:**

- Damage of the anterior horn cells with atrophy of muscles supplied by the damaged motor cells.
- Encephalitis in some cases.

★ Clinical picture:

The disease may manifest itself in the order of severity as:

- Subclinical infection.
- Abortive poliomyelitis.
- Non-paralytic poliomyelitis.
- Paralytic poliomyelitis.

❖ Abortive poliomyelitis:

1. Mild constitutional symptoms: fever, headache, malaise, sore throat and abdominal pain.
2. Diagnosis is impossible without viral identification so only suggested during epidemics.
3. CSF shows late increase in proteins (by 2-3 weeks).

❖ Non-paralytic poliomyelitis: = Manifestations of aborted +

- 1- Severe generalized muscle pain and tenderness.
- 2- Signs of meningeal irritation (see later)
- 3- Tripod sign: sits with hands thrown behind the back (for support)
- 4- Head drop sign: If we raise the trunk from behind the shoulder, the head drops back (not follow the plane of the trunk).
- 5- Paralysis of the bladder with urine retention.

☞ N.B. Early signs of progress from non-paralytic to paralytic polio:

- Disappearance of superficial reflexes (12-24 hrs before paralysis).
- Changes of deep reflexes (either ↑ or ↓) 12 hrs after loss of superficial reflexes.

❖ Paralytic poliomyelitis:

◆ Characters of paralysis in polio:

- Lower motor neuron lesion (muscle wasting, hypotonia, hyporeflexia)
- Asymmetrical (one limb is affected than others)
- Patchy distribution (affect some groups of muscles & sparing others in the same limb).

◆ Types of paralytic polio:

- 1- *Spinal form*: May be
- | | |
|---|--|
| { | → Lumbar → legs and lower abdomen affection. |
| | → Thoracic → upper abdomen and intercostal affection |
| | → Cervical → diaphragm, arms and neck affection. |

2- *Bulbar form*:

- ◆ Motor cranial nuclei esp. 9, 10, 12 (Palato - pharyngeal - laryngeal paralysis)
- ◆ Vital centers involvement:
 - ◇ Respiratory center → irregular breathing.
 - ◇ Vasomotor center → ↑ blood pressure, flushing, mottled skin.
 - ◇ Heat regulating center → disturbance of body temperature.

3- *Bulbospinal form*: Mixed between spinal and bulbar forms.

4- *Encephalitic form*: Fever, vomiting, drowsiness and coma so can not be distinguished from other causes of encephalitis.

◆ Complications:

1- Respiratory:

Respiratory insufficiency due to:

- ◆ Involvement of respiratory center in bulbar form.
- ◆ Recurrent aspiration which occurs in bulbar form.
- ◆ Involvement of intercostals or diaphragm in spinal form.
- ◆ Hypostatic pneumonia from prolonged recumbency.

2- Neurological:

Aphasia, inability to walk, according to the damaged part of nervous system.

3- GIT: Acute gastric dilatation or paralytic ileus.

4- Cardiovascular:

- ◆ Hypertension if involvement of VMC
- ◆ ↑ incidence of cardiac arrhythmia and pulmonary oedema.

5- Renal complications:

Urine retention may be associated with stone formation, UTI and even renal failure.

◆ Investigations:

1- Serum antibodies → Not diagnostic.

2- CSF examination: → Not diagnostic

-↑ cells → initially PNL's then lymphocytes. -↑ protein → later. -Normal glucose and chloride.

3- Viral isolation from throat, blood and stool ⇒ diagnostic.

◆ Differential diagnosis:

I- Non paralytic polio:

- 1- Meningitis: either purulent, T.B. or aseptic meningitis.
- 2- Meningism: in which signs of meningeal irritation occurs without meningeal infection e.g. pneumonia, typhoid fever,

II- Paralytic polio: Must be differentiated from causes of acute paralysis.

◆ Management:

1- Prophylaxis: By vaccination.

2- Abortive and non paralytic:

- ◆ Rest, sedation, analgesics, hot packs in muscular pain.
- ◆ Avoid precipitating factors (IM injection, trauma,)
- ◆ Prostigmine for urine retention (non paralytic polio)

3- Paralytic polio:

◆ Spinal polio:

- Acute stage*: • Strict bed rest, analgesics, sedatives.
• Immobilization and avoidance of precipitating factors.

Chronic stage: • Physiotherapy and orthopedic measures.

◆ Bulbar polio: —

- Maintenance of nutrition by tube feeding.
- Maintenance of respiration by postural drainage, antibiotics & oxygen.

◆ In respiratory failure:

Patient is put on mechanical ventilation until respiration is regained.

RABIES

* Pathogenesis:

- ⊙ **Organism** → RNA virus (Rabies virus)
- ⊙ **IP** → variable (2 w. → 6m) may be up to years.
- ⊙ **Route** → contaminated animal saliva through bite or scratch of warm blood animals.
- ⊙ **Reservoir** → Common → (Raccoon, bats, fox)
Rare → (dogs, cats, rats).
- ⊙ **Mechanism** →
The virus ascend through nerve trunk to reach the brain → serious encephalitis

* Clinical picture:

- ✧ **Prodroma:** (2-10 days).
 - Fever, Headache, Anorexia, Malaise.
 - Pain, Pruritis, Parasthesia at the site of the wound.
- ✧ **Neurological manifestations** (2 types)
 - 1- **Furious type:**
 - Hydrophobia (attempt for swallowing leads to pharyngeal spasm and aspiration so drooling of saliva & fear of water occur).
 - Aerophobia (current of air across the face leads to pharyngeal spasm).
 - Behavioral abnormality (hyperexcitability / hallucination).
 - Convulsions.
 - 2- **Paralytic type:** (uncommon)
 - Ascending flaccid paralysis

* D.D:

- ☆ Encephalitis.
- ☆ Tetanus.
- ☆ Acute paralysis (in paralytic type).

* Investigations:

- ☆ Viral isolation from salivary secretions, peripheral nerves or corneal smear.
- ☆ Negri bodies (inclusion bodies) detected by brain biopsy or autopsy.

* Prevention:

- ☆ Vaccination of domestic animals (dogs & cats).

* TTT:

- 1- **Specific ttt:** (after animal bite)
 - Active & passive → see non compulsory vaccination.
- 2- **Supportive measures:** (if manifestations occur)
 - Dark room, sedation, ttt of convulsions, → (as tetanus)
- 3- **If the animal lived for more than 10 days** after bite without appearance of the diseases no specific ttt is required.

* Prognosis:

- ☆ Death is usually the end result

C- infections due to gram +ve bacteria

SCARLET FEVER*** Pathogenesis:**

- ❖ **Cause:** Group A beta hemolytic streptococci "Erythrogenic toxin producing strain".
- ❖ **Route:** Droplet infection mostly direct.
- ❖ **I.P :** 2-7 days.

*** Clinical manifestations:****❖ Prodroma:**

- Sudden onset of fever, headache, sore throat & vomiting.
- Punctate exanthemes in the throat with tonsillar exudate similar to acute follicular tonsillitis.
- Tongue shows
 - Early swollen coated with prominent papillae "white strawberry tongue"
 - Late (after 3 days) → shedding of the white coat leaving beefy tongue with swollen papillae "Red strawberry tongue".

❖ Eruptive stage:

- Rash appears due to the erythrogenic toxins (in the 2nd day of fever).
- Starts in the axilla and groin then spread rapidly to involve trunk, face and extremities.
- In the face the perioral area is spared (Circumoral pallor).
- Rash is diffuse maculo-papular producing bright red discolouration of the skin which blanch on pressure, but deep creases show linear streaks which don't blanch on pressure (Pastia's sign).

*** Complications:****I- Non-suppurative**

- Acute rheumatic fever.
- Acute glomerulonephritis.
- Erythema nodosum (Red tender nodules in bony prominences esp. shin of tibia).
- Post-streptococcal reactive arthritis.
- Pediatric autoimmune neuropsychiatric disease associated with streptococcal infection (PANDAS).

II- Suppurative:

- Local extension: (Otitis media, sinusitis, mastoiditis, cervical lymphadenitis).
- Distant metastatic lesions (Arthritis, meningitis, sinus thrombophlebitis).

*** Investigations:**

- 1- Leukocytosis with marked neutrophilia.
- 2- ↑ Blood ASO titre during convalescence.
- 3- Throat culture for hemolytic streptococci.
- 4- Schultz-Charlton reaction (for diagnosis): Intradermal injection of 0.1 of antitoxin into an area of rash will result in blanching in this area due to toxin neutralization.
- 5- Dick test (for susceptibility) 0.1 ml toxin injected intradermally will lead to local erythema within 24 hrs. if the child is susceptible (non-immune) to scarlet fever.

✱ Management:

I- Of the patient:

- Bed rest, light food and fluids until fever subsides.
- Symptomatic treatment for fever, headache and vomiting.
- Specific treatment:
 - Penicillin for 10 days at least (oral or injection)
 - If the child is sensitive to penicillin, erythromycin is given for 10 days.

II- Of the contact:

- Isolation from the case.
- Treatment (Penicillin,) if the manifestations of the disease appear.

DIPHTHERIA

✱ Pathogenesis:

- Cause: *Corynebacterium diphtheria*: Gram +ve bacilli, non motile, non spore forming with exotoxin production.
- Route: As measles
- I.P.: 2-5 days

✱ Epidemiology:

- Highly fatal disease, now eradicated from most of countries.
- The organism has 3 types (Gravis, intermedius and mitis).

✱ Clinical manifestations:

- Prodroma ⇒ Gradual onset with low grade fever, headache, malaise and prostration.
- Clinical types ⇒ According to the site diphtheria may be:

1- Pharyngeal diphtheria:

- Starts by tonsillar and pharyngeal congestion then greyish white small dots appear on the tonsils and rapidly coalesce forming a membrane. The membrane is adherent to the tissues if forcibly removed it will leave a raw bleeding area. The membrane may spread to involve the uvula, soft palate, trachea,
- Enlarged cervical L.N. with surrounding oedema (Bull neck).

2- Laryngeal diphtheria:

- More common in infants, either 1ry or 2ry to pharyngeal diphtheria.
- Presented with: Brassy cough, stridor, hoarseness, up to upper respiratory obstruction with hypoxia and even death.

3- Nasal diphtheria:

- Very rare with mild constitutional symptoms..
- Characterised by serosanguinous nasal discharge with upper lip excoriation.

4- Other types:

- Rarely vulvovaginal, cutaneous, or even conjunctival affection may occur.

◆ Differential diagnosis:

- 1- **Pharyngeal (faucial) diphtheria:** From other causes of membrane on the pharynx:
 - Follicular tonsillitis • Agranulocytosis • Vincent's angina
 - IMN. • Oral moniliasis • Post tonsillectomy membrane.
- 2- **Laryngeal diphtheria:** From other causes of stridor.
- 3- **Nasal diphtheria:** From other causes of serosanguinous discharge e.g. FB, trauma.

◆ Investigations:

- **Identification of the organism** by throat smears and culture on special medias e.g. blood tellurite media and Löffler's media.
- **Susceptibility (Shick's test):** Intradermal injection of 0.1 ml of 1/50 concentration of the toxin to the contact. If erythema and induration occur about the 4th day the child is considered to be susceptible (non-immune) to diphtheria.

◆ Complications:

- 1- **Respiratory complications:**
 - 1st W: **Bronchopneumonia:** Common in laryngeal type due to 2^{ry} infection.
 - 1st W: **Lung collapse:** Due to mechanical obstruction of the small bronchi by the diphtheric membrane.
- 2- **Cardiovascular complications:**
 - 1st W: **Circulatory collapse:** Due to toxæmia or vasomotor changes.
 - 2nd W: **Myocarditis:** Manifested by H.F.
- 3- **Neurological complications:** Toxic polyneuritis in the following order:
 - 2nd-3rd W- **Palato pharyngeo-laryngeal paralysis:** → nasal speech, food regurgitation.
 - 3rd-4th W- **Ocular paralysis:** → squint, ptosis or loss of accommodation.
 - 6th W- **Generalized paralysis & Phrenic nerve paralysis** (last event)

◆ Management:

1- Of the patient:

- 1- **Isolation** until 3 successive negative cultures.
- 2- **Bed rest** for 2 weeks at least.
- 3- **Diphtheric antitoxin:**
 - Given in suspected cases without waiting for laboratory results.
 - 50 000-100 000 unit I.M. or I.V. single dose.
 - Sensitivity test must be performed before administration and better give corticosteroids to minimize sensitivity.
- 4- **Antibiotic therapy:**
Penicillin or erythromycin for 7-10 days to ↓↓ multiplication of the organism but has no effect on preformed diphtherial toxins.
- 5- **Treatment of complications:**
Especially tracheostomy in respiratory obstruction.

II- Of the contact:

1- Schick test and culture must be performed:

• Schick test	• Culture	• Comment	• Interference
+	+	Case	⇒ Treat as a case
+	-	Susceptible	⇒ If previous immunized give booster dose vaccine ⇒ If not, give antitoxin followed by active immunization.
-	+	Carrier	⇒ Antibiotic ttt for 10 days. ⇒ If culture still +ve after antibiotic ttt → tonsillectomy will be indicated.
-	-	Immune	⇒ Follow up.

2- If previous maneuvers (Schick test and culture) are not available the contact is given both antitoxin and antibiotic.

TETANUS "Lock Jaw"

• Pathogenesis:

❖ **Cause:** *Clostridium tetani* → Gram +ve non capsulated spore forming anaerobic bacilli with exotoxin production (produced only by vegetative form).

❖ Reservoir:

- Spores are found in dust, soil, water and animal excreta.
- Spore can survive in soil for several years and resist many injurious agents as boiling but destroyed by direct sunlight and autoclaving.

❖ Routes:

- Wounds
- Surgical procedures.
- Vaccination sites
- Umbilical stump.

❖ I.P:

1-12 days.

• Epidemiology:

Occurs throughout the world, prevalence is related to climate, spore distribution in soil and immunization level.

• Pathology:

- Tetanic bacilli are not invasive but proliferate locally and produce 2 types of toxins (tetanospasmin and tetanolysin).
- Tetanospasmin (neurotoxin) reaches the CNS through blood stream or migration through tissue spaces of nerve trunk to reach its target site in:
 - * the motor end plate of skeletal muscles
 - * the brain
 - * the spinal cord.

• Clinical manifestations:

Tetanus can present in different forms:

1- Localized tetanus:

- Occurs when infection is modified (e.g. previous antitoxin use)
- Produces pain and rigidity at the site of injury, which may persist up to weeks.
- No sequela and mortality rate below 1%.

2- Generalized tetanus:

- The most common form with insidious onset of restlessness, irritability and headache and mild fever then the following features usually occurs:
 - * Trismus → maseter spasm (the initial sign in > 50% of patients).
 - * Risus sardonicus → spasm of facial muscles.
 - * Laryngeal spasm → "Laryngismus stridulus" → suffocation.
 - * Opisthotonus → spasm of the muscles of the back.
 - * Tetanic seizures → characterized by flexed adducted arms, clenching of the fist and extension of LL, these fits are precipitated by any visual, auditory or tactile stimulus and the patient is fully conscious during the attack.

3- Cephalic tetanus:

- Follows otitis media or head injury by short incubation period (1-2 days)
- Most important feature is cranial nerve dysfunction.
- May be followed by generalized form.

☞ N.B. Tetanus neonatorum:

- Tetanus of generalized type. • Portal of entry is umbilical stump.
- Presents with difficult suckling and crying then difficult swallowing.

* Complications:

1- Respiratory:

- *Due to:* ↓ pulmonary ventilation by spasm of the larynx and respiratory muscles with accumulation of secretions.
- *Results in:* Aspiration pneumonia, collapse or pneumothorax.

2- GIT:

- Malnutrition or dehydration may occur if the course is prolonged.

3- Sequences of prolonged seizures:

- Tongue laceration • Muscular hematomas. • Vertebral fractures.

* Differential diagnosis:

1- Local causes of the jaw producing trismus:

e.g. parapharyngeal and retropharyngeal abscess.

2- Rabies:

May be difficult to D.D. as both conditions may follow animal bite but the spasm tends to be intermittent and clonic in Rabies with pleocytosis in CSF.

3- Strychnine poisoning:

In such condition, history of poison ingestion may be present and trismus occurs only after the onset of convulsions.

4- Tetany:

In which characteristic carpopedal spasm occurs, trismus rarely occurs.

N.B. Tetanus neonatorum should be DD from neonatal sepsis and from causes of neonatal convulsions

● Management:

I- Prevention:

- 1- **Active Immunization** (DPT or DT) at 2, 4, 6, 18 months + 4 years.
- 2- **Prevention of tetanus after injury:**
 - Surgical management of the wound (better left opened).
 - Immuno prophylaxis (according to immunization history).
- 3- **Prevention of tetanus neonatorum:** (maternal vaccination – aseptic cutting of the umbilical cord -).

II- Treatment

1- **Control of muscle spasm:**

- Place the patient in dark quite room where all possible auditory, visual, tactile and other stimuli are avoided.
- Diazepam 0.3-0.5 mg/kg I.V.& may be repeated every 4-6 hs.

2- **Antitoxin therapy:**

Human tetanus immunoglobulin (TIG) 3000-6000 unit I.M single dose is the best. If unavailable tetanus antitoxin (TAT) can be given after skin hypersensitivity testing in a dose of 50.000-100.000 unit ($\frac{1}{2}$ IV& $\frac{1}{2}$ IM).

3- **Antimicrobial therapy:**

To eradicate the vegetative clostridium tetani:

- Penicillin G 200.000 units/kg/day IV for 10 days.

4- **Supportive TTT:**

- IV fluids • Frequent suction • Mechanical ventilation if resp. arrest.

5- **Active immunization with toxoid:**

- Should be given to the patients one month after recovery as the disease does not confer immunity.

● Prognosis:

- Fatal disease, mortality rate about 55% and increase to more than 70% in neonates.

D- Infections due to gram -ve bacteria

ENTERIC FEVER

● Pathogenesis:

- ◇ **Cause:** salmonella typhi (typhoid fever) and paratyphi (Paratyphoid fever).
- ◇ **Route:** Feco-oral.
- ◇ **Reservoir:** Patient or carrier (Gall bladder, intestine or urinary bladder)
- ◇ **I.P. :** 1-2 weeks.
- ◇ **Mechanism:** the typhoid bacilli:
 - 1- Multiply in payer's patches.
 - 2- Cause initial bacteraemia.
 - 3- Settled & proliferated in RES.
 - 4- Followed by continuous bacteraemia and appearance of clinical manifestations.

*** Clinical picture:****● Prodroma (1st week)**

- ◊ **Fever:** Step ladder rising temperature (38°-40°).
- ◊ **Pulse:** Relative bradycardia.
- ◊ **Abdomen:** Pain, tender splenomegaly & constipation (rarely diarrhea).
- ◊ **General:** Headache, malaise & cough.

● Progress: (2nd week)

- ◊ **Fever:** High and continuous.
- ◊ **Pulse:** tachycardia may occur due to myocarditis.
- ◊ **Abdomen:** Splenomegaly, ± hepatomegaly & ± diarrhea.
- ◊ **General:** Headache disappears and replaced by delirium (status typhosus)

● End: (3rd week)

Step ladder fall of temperature, improve general condition, complications may occur.

*** Complications:**

- | | | |
|---------------------------------|-------------------------|---|
| 1- GIT: | ◊ Intestinal hge. | ◊ Intestinal perforation ± peritonitis. |
| | ◊ Splenic abscess | ◊ Complications of diarrhea |
| 2- Respiratory: | ◊ Epistaxis | ◊ Bronchitis. |
| 3- Renal: | ◊ Pyelonephritis | ◊ Cystitis. |
| 4- Locomotor: | ◊ Typhoid osteomyelitis | ◊ Spondylitis. |
| 5- Persistent infection: | ◊ Relapse | ◊ Carrier state |
| | | ◊ Chronic typhoid. |

*** Investigations:**

- 1- **Blood picture:** Leukopenia with relative lymphocytosis.
- 2- **Blood culture:** 80% +ve (in the 1st week).
- 3- **Stool culture:** +ve from the 2nd week.
- 4- **Urine culture:** +ve from the 3rd week (in 25% of cases).
- 5- **Widal agglutination test:** +ve from the 2nd week (> 1/160 titre)
(Anti-O → recent & Anti-H → recent or past and Vi-ab → suggest carrier).
- 6- **Bone marrow culture:** recently used as a reliable diagnostic method.

*** Management:****1- Prophylactic:**

- ◊ Isolation of the patient.
- ◊ Vaccination for highly susceptible children.
- ◊ Antibiotics for carriers → if no response → cholecystectomy.

2- Treatment:

- ◊ Bed rest, low residual diet.
- ◊ Management of complications.
- ◊ Symptomatic treatment for fever, headache,
- ◊ Antibiotics: Chloramphenicol or Amoxicillin 50-100 mg/kg/day every 6 hours preferably I.V.
3rd generation cephalosporins e.g. ceftriaxon are also effective.

WHOOING COUGH

Pertussis

* Pathogenesis:

- ◇ **Cause:** *Bordetella Pertussis* (Gm -ve small non motile bacilli).
- ◇ **Route:** Droplet infection. (Direct more than indirect).
- ◇ **I.P.:** 1-2 weeks (usually 7 days).
- ◇ **Infectivity:** Maximum during prodroma and early paroxysmal stage.

* Epidemiology:

- ◇ More common in young children.
- ◇ High mortality if occurs in infancy.
- ◇ No maternal acquired immunity because a very little maternal antibody cross the placenta (most adults have little immunity against pertussis).

* Clinical picture:

1- Cattarrhal stage: (1-2 weeks)

- Low grade fever • Conjunctival injection and lacrimation
 - Mild cough • Rhinorrhea ± viscid nasal discharge.
- (so always diagnosed as upper respiratory infection)

2- Paroxysmal stage: (4-6 weeks)

⌘ **Episodes of cough** increases in frequency and severity characterized by:

- Repetitive series of 5-10 coughs during single expiration followed by massive inspiratory effort producing the whoop as air is inhaled forcefully against narrow glottis. Vomiting is very common.
- Facial redness, bulging eyes, tongue protrusion and distended neck veins may accompany the attack.
- Attacks may be triggered by: sneezing, drinking & exertion.
- Inbetween the attacks the patient is usually stable.

☞ **N.B.** ○ The usual paroxysm may be absent in:

- Infants • Previously vaccinated • If bronchopneumonia develops.

3- Convalescent stage: (1-2 weeks)

- Gradual decline in frequency and severity of paroxysms.
- Cough may persist for months (in China it's called 100 day cough).

* Clinical types:

- 1- **Mild type:** Resembles acute attack of bronchitis.
- 2- **Classic type:** Typical picture with the 3 stages.
- 3- **Severe type:** Marked exhaustion of the patient with frequent complications.

* Investigations:

- ◇ **Typical presentation** may be enough for diagnosis.
- ◇ **Blood picture:** Leukocytosis with absolute lymphocytosis.
- ◇ **Culture of organism:** Nasopharyngeal swab on glycerine-potato blood agar media.

★ D.D:

Form other causes of chronic or persistent cough:

- 1- **Asthma**: Recurrent - wheezing - Responds to bronchodilators.
- 2- **Bronchitis**: Esp. chronic form (associated with fever, expectoration but no RD).
- 3- **Cystic fibrosis**: Associated with chronic diarrhea and +ve sweat chloride test.
- 4- **F.B. inhalation**: History + X-ray + bronchoscope.
- 5- **T.B.**: History of contact + investigations for T.B.
- 6- **Other causes**: Post nasal discharge, bronchiectasis, mediastinal syndrome & psychogenic.

★ Complication:

I- Respiratory:

- 1- **Bronchopneumonia**: By B.pertussis or 2ry bacterial infection.
- 2- **Bronchiectasis**: May develop and persists.
- 3- **Collapse**: 2ry to viscid plug.
- 4- **Emphysema**: from rupture alveoli.
- 5- **Activation of latent T.B. focus**. ± false - ve tuberculin test.
- 6- **Otitis media**: esp. 2ry to pneumococci.

II- GIT:

- 1- **Ulceration of tongue frenulum** (bitting during cough spills).
- 2- **Rectal prolapse and hernia** (Due to repeated straining).
- 3- **Emaciation** may occur (Due to repeated vomiting and anorexia).

III- Neurological:

- 1- **Convulsions during the attack**: Due to cerebral hypoxia.
- 2- **Tetany**: Due to repeated vomiting → Alkalosis.
- 3- **Paralytic and visual disturbance**: Reversible if caused by cerebral oedema or irreversible if caused by hge or encephalitis.

IV- **Hematological**: Epistaxis, melena, subconjunctival hge & spinal epidural hematoma may occur during severe cough episodes.

★ Management:

I- Of the patient:

1- Supportive care:

- ♦ Care of respiration (O₂ and suction of viscid secretion).
- ♦ Strong antitussive.

2- Antibiotics:

Erythromycin 30-50 mg/kg/d or ampicillin 50-100 mg/kg/d eradicate Pertussis within 3 days so prevent transmission but don't affect the course of the disease.

3- Passive immunization:

Pertussis immunoglobulin 1-2 ml/day I.M for 3 days for infants below 2 years

II- Of the contact:

- 1- **Previously immunized contacts < 7 years**: Erythromycin for 10 days + Booster dose of vaccine.
- 2- **Non immunized or age > 7 years**: Oral erythromycin only.
- 3- **Non immunized infants < 2 years**: Passive immunization.

E- Diseases caused by helminthes

I- INTESTINAL NEMATODES

	Ascaris	Hook worms "Ankylostoma"	Strongyloids	Pin worm "Enterobius"
Infective stage and Route	- Mature egg by ingestion	- Larvae by skin (rarely oral)	- Filariform larva skin penetration	- Embryonated egg by ingestion
Final habitat	Small intestine	Small intestine	Small intestine	Caecum
Clinical features	1- May be asymptomatic 2- Hypersensitivity with cough & dyspnea 3- Intestinal: abd. pain, distention,	1-2-3- As Ascariasis. 4- Occult blood in stool $\pm$ iron deficiency anaemia.	1-2-3 As Ascariasis. 4- Disseminated strongyloidiasis may occur due to massive invasion of internal organs by parasites larvae.	1- Nocturnal anal pruritis $\pm$ nocturnal enuresis 2- Sleeplessness, irritability.
Treatment	- Mebendazol & Flubendazol. 100 mg oral twice daily for 3d. - Levamisole "single dose"	As ascariasis + Treatment of anaemia	As ascariasis "Moderate response" or Thiabendazol 25mg/kg twice daily for 2 days "Most effective"	- As ascariasis but the drugs are given as single dose only for all the family and repeated after 2-3 weeks.

II- CESTODES (Tape worms)

	Taenia Saginata	Taenia Solium	Hymenolepis Nana	Echinococcus Granulosus
Life cycle	- Human is the definitive host while cattle are intermediate. - Infection occurs by ingestion of the "cysticercus bovis" in under cooked beef meat.	- Human is the definitive host while pork is the intermediate host. - Infection occurs by ingestion of "cysticercus cellulosus" in under cooked pork meat.	- Infection occurs by ingestion of eggs which hatch in the intestinal lumen giving embryo which forms the mature worm.	- definitive host is the dog while human, cattle or camels are intermediate. - Human ingests egg $\rightarrow$ embryo $\rightarrow$ liver, lung brain $\rightarrow$ formation of cyst "hydatid cyst".
Clinical picture	- Abdominal pain, distention, vomiting & wt. loss.	- The same as T.saginata	1- Abdominal 2- Irritability even convulsions due to neurotoxins	Presence of the Cyst = tissue Compression (2/3 rd in the liver)
Treatment	- Niclosamide "yomesan 500 mg" single oral dose 2 tab. $\Rightarrow$ 11-34 kg 3 tab. $\Rightarrow$ child > 34 kg 4 tab. $\Rightarrow$ adult. - Praziquantel 25mg/kg "Biltricide 600 mg"	- The same as T.Saginata but saline enema must be done one hour after therapy.	- Niclosamide the same doses as taenia but 1/2 the dose is given from the 2nd day for other 5 days. - Praziquantel the same as taenia	- High doses of Albendazol for long period "15 mg/kg/day" - Surgical removal of cysts with severe pressure manifestations.

III- TREMATODES

Schistosoma "Bilharziasis"

❖ Life cycle:

- 1- Infective stage "cercaria" in water will penetrate exposed skin to reach the circulation.
- 2- Then to hepatic portal venules where cercaria mature to adult worm in 1-3 months.
- 3- Then the adult worm migrates either to urinary bladder or intestine where it lodges eggs which pass with urine or stool.
- 4- If eggs reach fresh water they inhabit snails.
- 5- Further maturation within snails results in production of hundreds of cercaria which swim for 2 days searching for human being to penetrate his skin and so on.

❖ Types:

	• S. Japonicum ⇒	In Japan.
<i>Snail</i>	• S. hematobium	• S. Mansoni
<i>Habitat</i>	- <i>Bulinus Truncatus</i>	- <i>Biomphalaria Alexandrina</i> .
<i>Manifestation</i>	- Urinary Tract.	- Intestine
<i>Complications</i>	- Terminal hematuria.	- Abd. pain, diarrhea, melena.
	- Tumour producing "cancer bladder"	- Hepatic fibrosis → portal hypertension
<i>Prevalence</i>	- Trans Egypt.	- Lower Egypt only.

❖ Diagnosis:

- Urine and stool analysis for eggs.
- Rectal snap or bladder biopsy in confusing cases.
- Serology: Not accurate.

❖ Treatment:

- 1- Both types can be ttt with Praziquentel "Biltricide" → 40 mg/kg single dose oral (maximum 2.4 gm)
Niridazol "Ambilhar" → 15 mg/kg/day oral for 10 days

2- Drugs effective in S. haematobium only:

Metrifonate tab. "Bilarcil 100 mg tab." 10 mg/kg every 2 weeks for 3 doses.

3- Drugs effective in S. mansoni only:

Oxamniquine "Vansil 250 mg cap." 20 mg/kg/day oral for 3 days.

4- TTT of complications:

- Portal hypertension ± Bleeding varices. → see later
- Bladder cancer (surgery, chemotherapy & radiotherapy).

F- DISEASES CAUSED BY PROTOZOA

1- Amoebiasis:

- ✱ **Caused by** *Entamoeba histolytica* which inhabit the **large intestine**, present in two forms → cystic form (non invasive) and vegetative form (invasive).
- ✱ **Transmitted by:** Feco-oral route (the cyst).
- ✱ **Manifested by:**
 - Asymptomatic.
 - Intestinal amoebiasis.
 - Extra intestinal (Lung & liver abscess)
- ✱ **Treatment:**
 - ☉ *Cyst passers* "asymptomatic"
 - Diloxanide furoate "furamide" 10 mg/kg/day oral in 3 dose for 10 days.
 - ☉ *Invasive forms* "Symptomatic"
 - Metronidazol "flagyl" 50 mg/k/day (oral 3 doses) for 10 days or
 - Tinidazol "fasigyn" 50 mg/k/day (oral single dose) for 3-5 days.

2- Giardiasis:

- ✱ **Caused by** *Giardia lamblia* which inhabit the **upper small intestine**, present in two forms → cyst form (non invasive) and vegetative form (invasive).
- ✱ **Transmitted by:** Feco-oral route (the cyst).
- ✱ **Manifested by:**
 - Asymptomatic.
 - Diarrhea, abd. Distention and abd. pain.
 - May present as malabsorption syndrome.
- ✱ **Treatment:**
 - Furazolidine "Furaxone" : 8 mg/k/d (4 doses/day) ⇒ for 10 days.
 - Metronidazole "Flagyl" : 15 mg/k/d (3 doses/day) ⇒ for 7 days.
 - Tinidazole "Fasigyn" : 50 mg/k/d single oral dose.
 - Nitazoxanide for 3 days (Drug of choice).

Fever of unknown origin (FUO)

Documented fever which lasts more than 1 week in hospital (or 3 weeks in outpatient) without apparent cause by usual clinical examination & laboratory investigations

Causes

- 1- **Infections:** Malaria, TB, UTI, Brucella,
- 2- **Immune:** Rheumatoid arthritis, Rh. Fever, SLE.
- 3- **Granulomatous:** Crohn's, Sarcoidosis.
- 4- **Malignancy:** Leukemia, Lymphoma, ...
- 5- **Miscellaneous:** Kawasaki, Poisoning, DI & Familial Mediterranean fever.

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CHAPTER (VIII) NEONATOLOGY

RESUSCITATION OF THE NEWBORN

Definition: the efforts that are designed to aid the baby to establish the necessary physiologic changes in the transition from fetal to neonatal life

The physiologic changes that occur are related to:

- 1- Expansion of the lung.
- 2- Effective air exchanges with good pxygenation.
- 3- Termination of Rt-to-Lt shunt of circulation.

Goals of resuscitation:

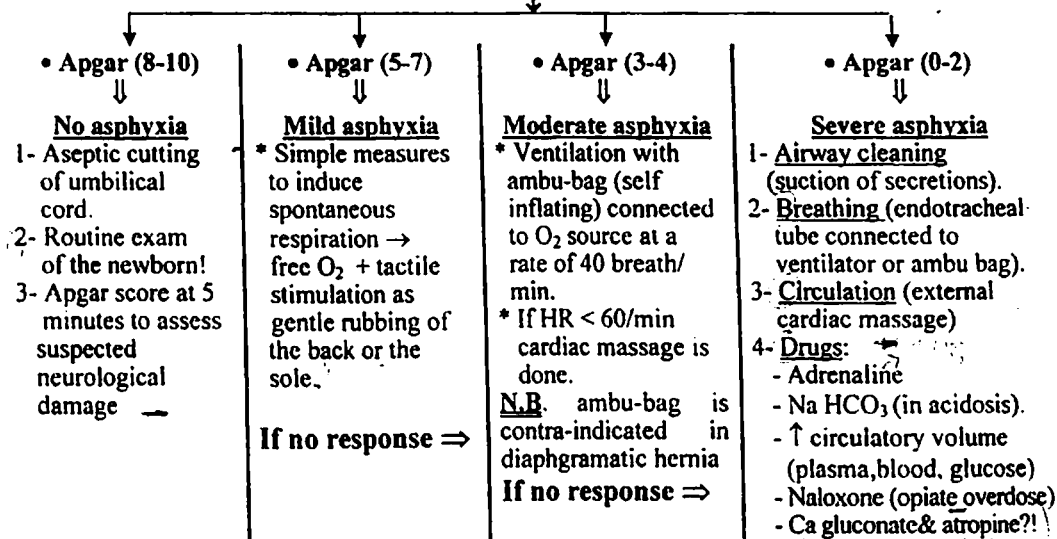
- 1- Expansion of the lung by cleaning upper airway and ventilation
- 2- Increase PO₂ by providing O₂ inhalation.
- 3- Cardiac output support
- 4- Decrease O₂ consumption by decreasing heat loss.

Steps:

- * Place the baby under radiant warmer.
- * Drying of the baby + suction of secretions.
- * Apgar scoring: Done at 1 minute to assess asphyxia.

Sign	0	1	2
• Colour (Appearance)	Blue or pale	Pink & blue extremities.	All pink.
• H.R. (Pulse)	Absent	< 100 / minute	> 100 / minute
• Response to nasal catheter (Grimace)	No response	Grimace	Cough, sneezing.
• Muscle tone (Activity)	Limp "flaccid"	Some flexion	Active motion
• Respiration (Resp.)	Absent	Slow ± irregular	Normal and crying

According to Apgar score (at 1 minute)



NEONATAL (PRIMITIVE) REFLEXES

☆ **Def:** Cerebral cortex of the newborn is not fully developed, so many stimuli may result in response of subcortical areas (brain stem or spinal cord). With time, maturation of cerebral cortex occurs and these reflexes disappear and replaced by specific cortical response.

Reflex	How to elicit.	Response	Time
1- Moro reflex	* Allow infant head to fall back wards on examiner's hand. (this method is better avoided in prematures or suspected ICHge). <u>Or</u> * Sudden removal of the blankets from below the infant. <u>Or</u> * Make a loud noise.	- Extension and abduction of UL, LL. <i>Then</i> ⇒ Flexion and adduction <i>Then</i> ⇒ Loud cry.	Birth → 6m
2- Rooting reflex	* Finger stimulation near the angle of the mouth.	* Turning of mouth to the stimulus side	Birth → 3m (7m. asleep)
3- Suckling reflex	* Stimulation of lips.	* Suckling movements	Birth → 3m (7m. asleep).
4- Palmer grasp	* Light touch of the palm of the hand.	* Grasp response	Birth → 3m
5- Solar grasp	* Light touch of the sole of the foot.	* Grasp response	Birth → 10m
6- Stepping reflex	* The infant is held upright with his soles touching a flat surface.	* Walking movement	Birth → 6w
7- Placing reflex	* The infant is held upright with the sole of one foot touching a surface of a table and the dorsum of other foot touching the under edge of the table.	* The baby will flex then extend the lower leg to place it on the upper surface of the table.	Birth → 6w
8- Tonic-neck ^o reflex	* While infant is supine the head is rapidly turned to one side.	* Extension of UL & LL on the side of turning and flexion of the other side.	2m → 6m
9- Neck ^o rightening Reflex	* While infant is supine the head is slowly turned to one side.	* The trunk will rotate to the new head direction.	6m → 24m
10- Landau ^o reflex	* The infant is raised in prone position supported from beneath abdomen by the hand.	* Extension of head, trunk and limbs.	3m → 24m
11- Parachute ^o reflex	* As landau but allow the infant to fall suddenly for a short distance.	* As landau	9m → persist

N.B. ^o → Primitive (non neonatal) reflexes.

☆ **Significance of neonatal reflexes:**

- ① **Their absence** at the time in which they normally present indicates damage of the subcortical area responsible for the initiation of the reflex e.g. Hypoxia-ischaemia, Brain damage,
- ② **Their presence** after the normal time for their disappearance indicate failure of development of the cortical area which suppress the reflex e.g. cerebral palsy.
- ③ **Unilateral response** to the reflex indicate unilateral injury of the brain stem, spinal cord or the involved peripheral nerve.
- ④ **Exaggerated response** to the reflex indicate CNS irritation e.g. early kernicterus.
- ⑤ **Determination of gestational age**: some reflexes as Moro & grasp appear at 28 w gestation so their presence in preterm may indicate that gestational age is > 28w.

II- BIRTH INJURIES

☆ Predisposing factors to birth injuries:

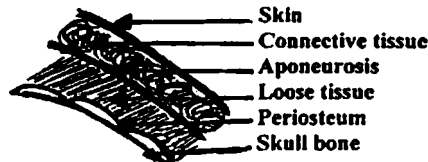
- * Large sized baby (Macrosomia) * Abnormal presentations (e.g. breech)
- * Instrumental delivery. * Prolonged or obstructed labour.

☆ Types of birth injuries:

- ① Cranial injury ② Nerve injury ③ Bone injury ④ Soft tissue injury.

I- CRANIAL INJURIES

a- Scalp lesions:



	* <u>Caput succedaneum</u>	* <u>Cephalhematoma</u>
* Nature ⇒	- Serosanguineous subcutaneous collection	- Hemorrhagic sub-periosteal collection.
* Onset ⇒	- Immediate after birth	- Few hours after birth.
* Site ⇒	- Presenting part	- Any bone (usually parietal or occipital)
* Extent ⇒	- Diffuse (cross the suture lines)	- Localized (the sutures prevent its spread).
* Consistency ⇒	- Soft	- Firm (± depressed fracture)
* Associated features	- Ecchymotic skin patches	- Skull fractures - Anaemia and Jaundice (if large).
* Fate ⇒	- Usually disappear gradually (within few days)	- Resolution slowly over few weeks (infection, calcification or even ossification may occur).
* TTT ⇒	- Nothing	- TTT of anaemia (blood transfusion), jaundice (± phototherapy) & infection (antibiotics) - Incision and drainage are contraindicated. (Except if abscess developed)

* Subgaleal hematoma:

- Bloody collection in subgaleal space (potential space between periosteum and galea aponeurotica).
- It extends from orbital ridges anteriorly to the occiput posteriorly and up to ears laterally.

b- Skull bone fracture:

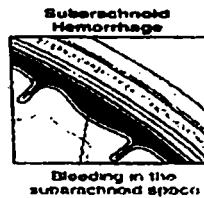
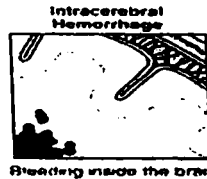
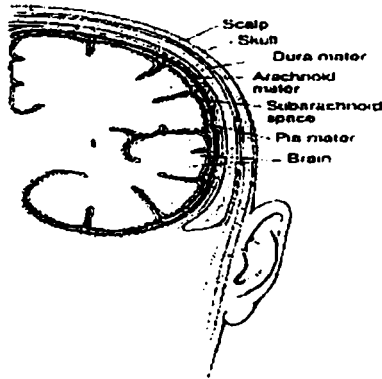
* Aet. → Birth trauma.

- * Type →
- Linear (fissure) fracture: Asymptomatic, No ttt.
 - Depressed fracture:
± focal neurological lesions, ttt by neurosurgical consultation (elevation of the depressed bone).

c- Intracranial Hge (ICH):

- * Aetiology
 - Birth trauma: instrumental, obstructed labour.
 - Hypoxic-ischaemic encephalopathy (esp. prematures)
 - Bleeding disorders.
- * Types
 - Anterior fossa Hge (cerebral or subdural)
 - Posterior fossa Hge (cerebellar or subdural).
 - Germinal matrix hemorrhage/intraventricular hge(GMH/IVH)
 - Subarachnoid He

Cross Section of the Brain



* C/P

- 1- Neurological signs:
 - Absent or depressed reflexes.
 - Bulging anterior fontanelle
 - Convulsions.
 - Drowsiness → stupor → coma.
- 2- Signs of blood loss: (pallor, shock and poor feeding).

* Investigations:

- 1- CBC → Anaemia.
- 2- Lumbar puncture (not recommended).
- 3- Cranial ultrasound or CT brain ⇒ diagnostic.
- 4- Coagulation profile (PT , PTT)

* Treatment:

- 1- Supportive care (incubator care, O₂ and fluids)
- 2- Minimal handling of the baby.
- 3- Blood transfusion.
- 4- Treatment of convulsions e.g. IV phenobarbitone
- 5- Treatment of the cause (e.g. Hgc disease of the newborn by vit. K injection)
- 6- brain dehydrating measures (like IV mannitol and hyperventilation) are controversial.
- 7- Follow up for complications like post-hemorrhagic hydrocephalus.

N.B.Germinal matrix hemorrhage/intraventricular hemorrhage

It occurs mainly in preterm infants. It originates from the fragile vessels of the subependymal germinal matrix.

2- NERVE INJURIES

- Spinal cord
- Brachial plexus
- Phrenic nerve
- Facial nerve

☆ Spinal cord injury:

- * Aetiology:
 - Traction on trunk during breech delivery.
 - Delivery with hyperextended neck.
- * C/P:
 - Low Apgar score at birth with apnea.
 - Paralysis below the level of the lesion.
 - Urine retention and constipation.
- * Management:
 - Confirm diagnosis by CT and MRI.
 - Supportive care then rehabilitation.

☆ Brachial plexus injury:

- * Aetiology:
 - Traction on the head and neck during delivery of the shoulders in vertex presentation.
 - Traction on the shoulders during head delivery in breech presentation.
- * Types:
 - ① Injury to upper nerve roots (C₅, C₆) ⇨ Erb's palsy
 - ② Injury to lower nerve roots (C₇, C₈, T₁) ⇨ Klumpke's paralysis
 - ③ Entire brachial plexus injury in which the affected limbs is flaccid with loss of all reflexes.

	◇ Erb's palsy	◇ Klumpke's palsy
⊕ <u>Affected muscle</u>	* Deltoid → loss of abduction * Supra and infraspinatus → loss of external rotation. * Biceps and supinator → loss of supination. ⇓ The net result will be adduction, internal rotation and pronation → waiter's tip position.	* Paralysis of all intrinsic muscles of the hand.
⊕ <u>Reflexes</u>	* Absent Moro and preserved Grasp on the affected side	* Absent Grasp and preserved Moro on the affected side.
⊕ <u>Association</u>	* Impaired sensation over the external surface of the upper limb. * May be associated with phrenic nerve palsy (C₃, C₄, C₅)	* If injury to sympathetic fibres of T₁ → Horner syndrome (ptosis, meiosis, enophthalmos and anhydrosis).
⊕ <u>Treatment</u>	1- Partial immobilization in position opposite to the lesion → abduction, external rotation and supination. 2- Physiotherapy 7-10 days later (after resolution of nerve oedema). 3- If no improvement after 3 months surgery is needed (neuroplasty – nerve grafting)	1- Hand is kept in neutral position with pad of cotton in the fist (hand writing position).

☆ Facial nerve injury:

- * Aetiology:
 - Compression during delivery by forceps.
- * C/P: (Usually LMNL)
 - Inability to close the eye firmly on affected side.
 - Obliteration of nasolabial fold on affected side.
 - Deviation of the angle of mouth to healthy side.
- * TTT:
 - Care of the eye.
 - Spontaneous improvement usually occurs $\Rightarrow$ if not $\rightarrow$ physiotherapy.

☆ Phrenic nerve injury: (C_{3,4,5})

- * Aetiology:
 - Birth trauma (usually associated with Erb's palsy).
- * C/P:
 - Respiratory distress.
 - Paradoxical breathing (No abdominal bulge during inspiration).
 - $\downarrow\downarrow$ breath sounds on the affected side.
- * Investigations:
 - X-ray chest $\rightarrow$ elevation of the copula of the diaphragm on affected side + mediastinal shift to the other side.
 - Fluoroscopy $\rightarrow$ paradoxical movement of the affected copula of the diaphragm
- * Treatment
 - Place the infant on the affected side.
 - O₂ + suction of secretions.
 - IV fluids then nasogastric tube feeding.
 - If no spontaneous recovery within 3 months surgery is recommended (diaphragmatic plication)

3- BONE INJURIES

$\rightarrow$ Fracture clavicle
 $\rightarrow$ Fracture long bones

☆ Fracture clavicle:

- * Aetiology:
 - Usually due to traction on shoulder in vertex presentation. It is the commonest bone to be fractured in neonates.
- * C/P:
 - ① Absent Moro reflex on the affected side.
 - ② Pseudo paralysis of the affected side.
 - ③ Crepitus and bone irregularity on the affected side.
(In green – stick fracture it may be asymptomatic).
- * Investigations: $\Rightarrow$ X-ray chest confirm the diagnosis.
- * TTT : $\Rightarrow$ Immobilization of arm and shoulders (figure of 8 bandage).

☆ Fracture long bones:

- - Loss of spontaneous limb movement and Moro (according to the fractured bone site).
 - Swelling and painful movement of the limb.
- * TTT : $\Rightarrow$ Splint, bandage or cast.

4- SOFT TISSUE INJURIES

→ Sternomastoid injury
→ Visceral injury

☆ **Sternomastoid muscle injury:**

- * **Aetiology:**
 - Traction on the neck during delivery
- * **C/P:**
 - Muscular hematoma which calcify → firm mass (sternomastoid tumour)
 - 2ry shortening of the muscle → torticollis.
- * **TTT**
 - Physiotherapy to lengthen the short muscle.
 - If resistant → incision for cosmetic appearance.

☆ **Visceral injury:** (Intra-abdominal)

- * **Aetiology:** Traction on the trunk during breech delivery

* **Forms:**1- **Liver or spleen injury:**

- Shock, pallor.
- Abd. distention and bluish discoloration of abd. wall.
- Abd. sonar is diagnostic
- TTT by blood transfusion + surgical exploration.

2- **Adrenal hge:** (Newborn adrenal gland is large, friable and highly vascular so liable for trauma).

- If severe bilateral → shock
- If moderate bilateral → signs of hypo-adrenalism.
- If mild or unilateral → asymptomatic and accidentally discovered (calcified adrenal in X-ray)
- Investigations by abd sonar , serum Na , K and blood glucose.
- TTT by IV fluids + hydrocortisone.

III- NEONATAL INFECTIONS

CONGENITAL INFECTIONS

(TORCH)

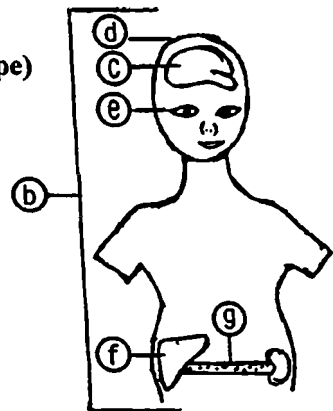
* Pathogenesis:

	Toxoplasma	Rubella	Cytomegalo virus	Syphilis	Herpes simplex
- Organism	- Toxoplasma gondi (protozoa)	- Rupella virus (RNA)	-CMV (DNA)	- Treponema pallidum (spirochete)	- HSV (DNA)
- Maternal infection	- Ingestion of oocyte passed in stool of cats	- Droplet (German measles)	- Sexually transmitted - Parenteral	- Sexually transmitted - Parenteral (rare)	- Sexually transmitted
- Routes of neonatal infection	- Trans-placental	- Trans-placental (esp. 1 st trimester)	- Transplacental - Perinatal (genital secretions)	-Transplacental	-Transplacental - Perinatal (genital secretions)

* Clinical picture:

1- Non specific manifestations: (May occur in any type)

- a- Asymptomatic
- b- Low birth weight.
- c- MR.
- d- Microcephaly.
- e- Eye (chorioretinitis / cataract / microphthalmia).
- f- Hepatosplenomegaly.
- g- Hematological (purpura / pallor).



2- Specific manifestations:

Toxoplasma	Rubella	CMV	Syphilis	Herpes simplex
- Abortion or still birth. - Hydrocephalus	- Deafness. - CHD (PS, PDA & coarctation). - Polycystic kidney.	- Deafness. - Periventricular calcification (in X-ray skull). - Cholestasis.	- Early: HSM, jaundice, LN ++ & anaemia - Later: chronic CNS, CVS, skeletal & teeth problems	- If perinatal: 1- Skin, eye & mouth lesions 2- CNS infection 3- Sepsis like (disseminated disease)

* **Investigations:**

1- Non specific

- CBC.
- Fundus exam.
- Sonar abdomen.
- LFT.
- ECHO
- X-ray or CT skull

2- Serology:

- ↑ Serum specific IgM or rising IgG titre.
- \$ → non treponemal tests (e.g. VDRL) or treponemal tests which are specific.

3- Identification of the organism: in

- Blood (Toxoplasma).
- Nasopharynx (Rubella).
- Dark field microscopy (Syphilis).
- Urine (CMV)
- Skin lesions (HSV).

* **Prevention:**

1- Toxoplasma → (Avoid cats & raw meat)

2- Rubella → ♦ MMR vaccine

♦ If pregnant ♀ is infected during the first trimester

→ Abortion (if the mother accepted).

→ Immune serum globulins (ISG) if refused abortion.

3- Avoid maternal infection with CMV, HSV, Syphilis.

* **Treatment:**

1- Supportive measures & ttt of complications.

2- Rehabilitations.

3- Specific therapy:

♦ Pyrimethamine, Folinic acid & Sulphadiazine → for Toxoplasma.

♦ Gancyclovir → for CMV.

♦ Acyclovir → for HSV.

♦ Penicillin → for Syphilis.

♦ No specific ttt → for Rubella.

NEONATAL SEPTICAEMIA

☆ **Def:** Serious clinical condition characterized by systemic illness and documentation of infection resulting from the presence of multiplying bacteria and their toxins in the blood.

☆ **Pathogenesis:**

Neonatal sepsis may present early after birth (1st week) related mainly to maternal factors or present later (8-28 days) related to environmental or nosocomial factors.

	• Early sepsis	• Late and nosocomial sepsis
• <u>Organism</u>	1- Group B streptococci 2- Others: - E.Coli - Listeria monocytogenous - H. influenza - Pneumococci.	1- Staphylococcus aureus. 2- Others: - Klebsiella. - Pseudomonas. - Viral or candida - ± same causes of early sepsis.
• <u>Risk factors</u>	1- Prematurity 2- Maternal intrapartum fever, uterine tenderness, chorioamnionitis or PROM ≥ 18 hours.	1- Prematurity. 2- Hospitalization, umbilical catheterization, endotracheal intubation or mechanical ventilation.

☆ Clinical presentations:

1- Asymptomatic:

Absence of manifestations do not exclude sepsis if multiple risk factors are present, so antibiotics must be carried out till -ve culture results are obtained.

2- Non-specific manifestations:

Early manifestations of sepsis are usually vague including: lethargy, poor suckling, hypothermia (commoner than fever) and depressed reflexes.

In general → (the baby is not doing well).

3- Systemic involvement: Any organ may be affected esp. late in untreated sepsis:

- Pneumonia • Hepatitis • G.E. • Pyelonephritis.
- Myocarditis • Arthritis • Hemolysis • Meningitis (30 %).

4- Complications:

- Septic shock → skin mottling, tachycardia and hypotension.
- Septic renal failure → oliguria, oedema and acidosis.
- Sclerema → hardening of the skin (Poor prognosis).
- DIC → purpura, bleeding from puncture sites and gangrene.

☆ Investigations:

1- Sepsis screen: Septicaemia is suggested when:

- * WBC's count < 5000 or > 25000 / cc. * Neutropenia < 1000/cc.
- * Band count > 20% * ↑ESR * +ve CRP and procalcitonin.

2- Identification of the causative organism:

- * By appropriate cultures of (Blood, CSF, urine, stool and endotracheal aspirate).

3- Lumbar puncture:

- * May show evidence of meningitis (see later)

4- PT, PTT and FDPs for evidence of DIC.

5- Chest x-ray for neonatal pneumonia.

6- ABG, liver and kidney functions as indicated.

☆ Management:

- * Prophylactic: By proper perinatal care and ttt of maternal infections.

- * Curative:

1- Supportive measures:

- Hospitalization (preferably in NICU) & ttt of complications.
- Respiratory support (O₂, suction ± mechanical ventilation).
- Feeding: Oral (if good suckling without R.D.) may be tube feeding, IV fluids or even Total Parenteral Nutrition.

2- Specific measures:

- Antibiotics are given according to C & S.
- While waiting for culture results antibiotic combination is given as following:
 A- in early onset sepsis IV Ampicillin and gentamycin combination is given.
 B- In late onset sepsis Vancomycin plus 3rd generation cephalosporin or amikacin
- All antibiotics should be given parenterally for 2 weeks (3 weeks in case of associated meningitis).
- Antifungal drugs like voriconazole (Vefend) are added if there is fungemia.

3- Treatment of resistant cases:(Immune therapy)

- Exchange transfusion esp. in DIC.
- I.V. gamma globulins for 5 days.
- Recently Grnulocyte transfusion, G-CSF or fibronectin can be added.

TETANUS NEONATORUM

"An infection caused by anerobic spore forming clostridium tetani .

incubation peroid 5-14 days (may range 1-30 days)

♦ Routes of entry:

- Through the umbilicus by:
 - 'Using contaminated scissors cutting the cord
 - Contaminated dressing covering the cord
- Where the neurotoxins of the organism reach the anterior horn cells along the nerves or through the blood stream

♦ Clinical picture:

- 1- The onset is gradual with refusal of feeding → then after 2 days: trismus (lack jaw) start to appear with difficulty to open the mouth and inability to suck.
- 2- Stiffness of all muscles increase gradually leading to board like rigidity, opisthotonus, stiff extended limbs with clenched fists and spasm of the fascial muscles (Risus sardonicus).
- 3- Convulsions: (tonic) precipitated by slightest stimulus if affecting laryngeal "or respiratory muscles causing cyanosis.

♦ Causes of death:

- Prolonged larygeal spasm
- Pneumonia
- Laryngeal obstruction by secretions

♦ Treatment:**1- Supportive:**

- Incubator care if needed
- Respiratory support: O2 therapy, suction, mechanical ventilation
- Cardiac support.....
- Correction of electrolytes
- Control of convulsion by diazepam
- Quiet room with minimal stimulation

2- Specific:

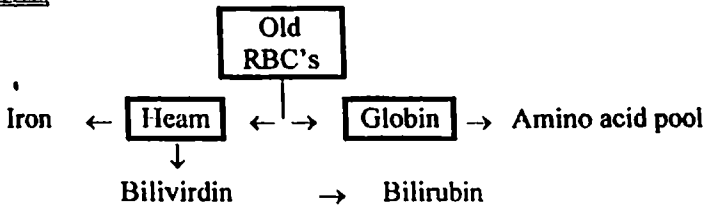
- Anti tetainc serum
- Aqueous pencillin

IV- NEONATAL JAUNDICE

- * Jaundice (Hyperbilirubinaemia) is yellowish discoloration of skin and mucus membranes due to $\uparrow\uparrow$ serum bilirubin above normal levels
- * Clinically, jaundice is obvious when serum bilirubin increase $> 2 \text{ mg/dl}$ in adults (5 mg/dl in neonates)

BILIRUBIN METABOLISM

I- Production



II- Transport

- * Bilirubin is carried on albumin (so called unconjugated, indirect or hemebilirubin)

III- Uptake by liver

- * Uptake is enhanced by Z & Y proteins.

IV- Conjugation

- * Conjugation of bilirubin by glucuronyl transferase enz. in liver $\Rightarrow$ conjugated, direct or cholebilirubin.

V- Secretion

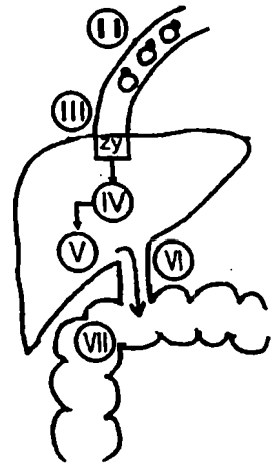
- * Active secretion of conj. bilirubin by liver cells.

VI- Excretion

- * Excretion of conjugated bilirubin & bile salts into the intestine.

VII- Bilirubin in intestine:

- * Some amount is reabsorbed $\rightarrow$ liver (entero- hepatic circulation)
- * Some amount changed to stercobilinogen $\rightarrow$ stool (responsible for the colour of stool)
- * Very small amount changed to urobilinogen $\rightarrow$ blood $\rightarrow$ urine (not responsible for the colour of urine)



CAUSES OF HYPERBILIRUBINAEMIA

UNCONJUGATED

(Conjugated bilirubin <15% of total)

1- ↑ Production:

- Hemolytic disease of the newborn (Rh & ABO incompatibility)
- Membrane defect (spherocytosis and elliptocytosis)
- Enzyme defect (G6PD↓)
- Hemoglobinopathy (α -thalassaemia)
- Synthetic vit. K administration
- Sepsis
- Large cephalhematoma

2- Defective transport:

- ↓ Albumin (e.g. Nephrosis).
- Displacement of bilirubin from protein binding sites (e.g. Ampicillin, Aspirin, Warfarin)

3- Defective uptake:

↓ Z, Y proteins "Gilbert disease" → AD, mild disease.

4- Defective conjugation:

Glucoronyl transferase enzyme:

- **Absence** (Crigler Najjar Type I → AR).
Poor prognosis
- **Deficiency** (Crigler Najjar type II → AD).
Less severe than type I
- **Immaturity** (Physiological jaundice).
- **Lack of stimulation** (Cretinism)
- **Inhibition** (Breast milk jaundice) →

Due to:

- 1- Pregnanediol & non-esterified fatty acids present in breast milk.
 - 2- ↑ enterohepatic circulation due to presence of β glucuronidase in breast milk that deconjugate bilirubin.
- Bilirubin may rise up to 10-30 mg/dl during the second week of life and return to normal by 4-12 weeks with good general condition & weight gain.

CONJUGATED

(Conjugated bilirubin ≥15 % of total)

1- Defective secretion of conjugated bilirubin by hepatocytes:

- Rotor and Dubin Jonson syndromes (AR)
- Neonatal hepatitis either sepsis, idiopathic or TORSCH
- Metabolic as galactosemia, tyrosinaemia or α_1 antitrypsin deficiency

2- Defective excretion (Bile flow obstruction)

• Intrahepatic:

- Congenital intrahepatic biliary atresia.
- Viral hepatitis

• Extra hepatic:

- Congenital extrahepatic biliary atresia.
- Biliary tumours or stones.
- Inspissated bile syndrome:
(prolonged unconjugated hyperbilirubinaemia leads to increase production of conjugated bilirubin by the liver which accumulates in biliary canaliculi obstructing them → changing the condition to conjugated hyper-bilirubinaemia).

N.B.

The commonest causes of conjugated hyperbilirubinaemia are:

- 1- Idiopathic neonatal hepatitis
- 2- Extra hepatic biliary atresia
- 3- α_1 antitrypsin deficiency

APPROACH TO DIAGNOSIS OF NEONATAL JAUNDICE

I- History:

*** Maternal history:**

- Previous abortion or blood transfusion.
- Infection or drug intake during pregnancy.

*** Family history:**

- Consanguinity
- Similar attacks

*** Perinatal history:**

- Instrumental delivery → cephalhematoma
- Prematurity
- Synthetic vit. K administration or drug intake.

*** Time of appearance of jaundice:**

- **Jaundice appear in the 1st day of life:**
 - ♦ Hemolytic disease of the newborn (RH or ABO).
 - ♦ TORCH
- **Jaundice appear in 2nd – 3rd day of life:**
 - ♦ Physiological jaundice
 - ♦ Crigler Najjar syndrome.
 - ♦ TORCH
- **Jaundice appear in 4th – 7th day of life:**
 - ♦ Delayed physiological jaundice
 - ♦ Cephalhematoma.
 - ♦ TORCH
 - ♦ Neonatal sepsis.
 - ♦ Hemolytic anaemias (G6PD ↓, spherocytosis,)
- **Jaundice appear after the first week of life:**
 - ♦ Breast milk jaundice.
 - ♦ Congenital biliary atresia.
 - ♦ Galactosemia.
 - ♦ Neonatal hepatitis.
 - ♦ Cretinism.

N.B. $\Rightarrow$ (Cong. biliary atresia, Neonatal hepatitis and Galactosemia are usually associated with jaundice which persist beyond neonatal period).

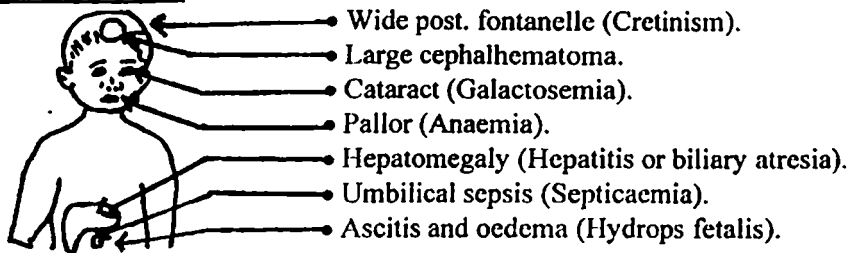
II- Examination:

*** To D.D. conjugated from unconjugated:**

- Colour of sclera ⇒ Lemon yellow → unconjugated.
 ⇒ Olive green → conjugated.
- Urine and stool ⇒ Normal urine ± dark stool → unconjugated.
 ⇒ Dark urine and clay stool → conjugated.

✱ **To detect the level:** If jaundice reaches to certain body sites:

- Face → 5 mg/dl
- Chest 10 mg/dl
- Thigh 15 mg/dl
- Sole 20 mg/dl

* To detect the cause:III- Investigations:

Serum Bilirubin

Unconj. Hyperbilirubinaemia

- ↓Hb % and ↑Reticulocytic count.

Present (hemolytic)

- Blood grouping for baby & mother.
- Coomb's test.
- Investigations for spherocytosis and G6PD.
- Sepsis screen

Absent (non hemolytic)

- T_4 & TSH
- Sepsis screen

Conj. Hyperbilirubinaemia

- Liver function tests.
- Liver scan (HIDA scan).
- Fasting abdominal US.
- Liver biopsy.
- Metabolic screen e.g. galactosaemia
- TORSCH screen.
- Sepsis screen.

PHYSIOLOGICAL JAUNDICE☆ Aetiology:

- 1- Immaturity of Glucuronyl transferase enzyme.
- 2- Short life span of neonatal RBC's.
- 3- Low Y & Z protein levels in liver cells during the first week of life.
- 4- ↓ breast milk leads to ↓ calories & dehydration → ↑ enterohepatic circulation.
- 5- Other factors: polycythemia, cephalhematoma, bruises.

☆ Incidence:

- * The commonest cause of neonatal jaundice occurs in 40% of full term & 60% of preterm.

☆ Characters:

- * Unconjugated hyperbilirubinaemia.
- * Mild to moderate rise of serum bilirubin.
- * Usually start in the 2nd or 3rd day of life.
- * Usually disappear within 1-2 weeks.
- * No associated problems, No risk of kernicterus.

☆ D.D.: Physiological jaundice must be differentiated from other causes of jaundice.

	Physiological Jaundice	Pathological Jaundice
* Onset	• 2 nd or 3 rd day (4-7 in preterm)	• Any time (even 1 st day)
* Duration	• About one week in full term (2w. in preterm)	• May be longer
* Rate of rise	• < 5mg/dl per day.	• > 5mg/dl per day
* Peak level	• < 12 mg/dl (15 in preterm)	• May be higher.
* Type	• Unconjugated	• Unconjugated or conjugated.

☆ **TTT**: Physiological jaundice usually resolves spontaneously, in exaggerated cases phototherapy may be needed.

N.B.

1- Exaggerated physiological jaundice:

- ▣ Serum bilirubin > 15 mg/dl.
- ▣ Risk factors: Male sex, breast milk feeders and polycythemia.

2- Prolonged physiological jaundice:

- ▣ Physiological jaundice persists more than 2 weeks.
- ▣ Risk factors: Cretinism, pyloric stenosis and constipation (↑ enterohepatic circulation).

3- Physiological jaundice of prematures:

- ▣ More common. 6-8%
- ▣ Late onset (± 4th day).
- ▣ Higher level (± 14 mg/dl)
- ▣ Prolonged duration (± 2 weeks).

TREATMENT OF NEONATAL JAUNDICE

I- Indirect (unconjugated) hyperbilirubinemia

1- PHOTOTHERAPY:

* **Idea:** Exposure of neonate with unconjugated hyperbilirubinemia to blue or white light with wave length (420-470 nm) will convert unconj. bilirubin to non toxic photoisomers like lumirubin which are excreted in urine and bile.

* **Indications:**

- 1- Rise of bilirubin to high levels (but below the critical levels when kernicterus may occur).
- 2- During waiting for exchange transfusion.
- 3- Prophylactic in:
 - Very low birth weight.
 - Severely bruised neonates.
 - Immediately after birth if Rh incompatibility is suspected.

* **Contraindications:** Direct hyperbilirubinemia → Bronzed baby syndrome.

* **Procedure:**

- The baby should be completely exposed covering only eyes and genitalia.
- Exposure should be continuous with short intervals for feeding (Excess fluid is necessary to prevent dehydration).
- Change the position of the baby every now and then.
- Recording of temp. is important every 6 hours.
- Discharge from phototherapy when bilirubin level is low enough that no risk of kernicterus will be present:
 - 13 ± 0.7 mg/dl in full term.
 - 10 ± 1.2 mg/dl in preterm.

* **Side effects:**

- | | |
|---------------------------------|---|
| 1- Hyperthermia | 4 Dehydration |
| 2- Skin rash | 5 Damage to eye or genitalia |
| 3- Hypocalcaemia in prematures. | 6- Diarrhea (due to ↑ bile salts in stool). |

2- EXCHANGE TRANSFUSION:

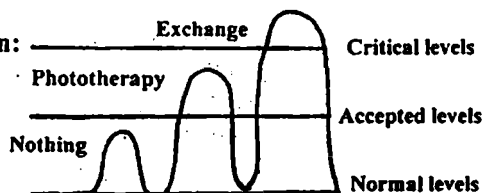
* Idea:

- Removal of excess unconjugated bilirubin.
- In cases of Rh. incompatibility it corrects anaemia and remove antibodies from the circulation.

* Indications:

1- In hemolytic disease of the newborn:

- Cord bilirubin > 5 mg/dl.
- Cord hemoglobin < 10 gm/dl.
- Rapid rise of serum bilirubin (> 1 mg/dl/hour or > 5 mg/dl/day).
- Bilirubin level exceeding:
 - 10 mg/dl at first day.
 - 15 mg/dl at second day.
 - 20 mg/dl at any time.
- History of kernicterus in a sibling.



2- In any cause:

- Serum bilirubin exceeding critical values (20-25 mg/dl).
- Early signs of kernicterus e.g. refusal of feeding or high pitched cry.

* Procedure:

- Blood used is O $\bar{v}$ e compatible with both maternal and neonatal blood.
- Amount needed is double the blood volume of the neonate (2×85 ml/kg).
- Small amount of blood (10-20 ml) is removed and replaced by equal amount of the new blood every few minutes.

* Side effects:

- 1- Hazards of umbilical catheterization
e.g. embolism, thrombosis, sepsis & portal hypertension.
- 2- Hazards of blood transfusion.
- 3- Heart failure ($\uparrow\uparrow$ load on the heart).
- 4- Hypocalcaemia, hypoglycaemia, hyperkalaemia.

- * Other indications for exchange transfusion:
- NEC
 - Neonatal sepsis.
 - Polycythaemia.
 - Anaemic heart failure.

3- OTHER LINES OF TTT:

* Phenobarbitone:

- Induce glucuronyl transferase enzyme esp. in Crigglar Najjar syndrome type II.

* Agar agar therapy

* Treatment of the cause:

- TTT of sepsis, hypothyroidism,
- Avoid drugs which displace bilirubin from plasma protein binding sites..
- In breast milk jaundice: Stop breast feeding for 24-48 hours only (jaundice will disappear and not recur).

II- Direct (conjugated) hyperbilirubinaemia

1- TTT OF THE CAUSE: * Sepsis, Galactosaemia, hypothyroidism

- * Surgery for biliary atresia (Hepatic porto-enterostomy of Kasai operation).

2- NON SPECIFIC TTT:

- * Corticosteroids
- * Phenobarbitone.
- * Choleretics (e.g. cholestyramine)

} → Doubtful results

KERNICTERUS

☆ Definition:

Yellowish discoloration of brain cells especially basal ganglia due to deposition of unconjugated bilirubin. It is better named bilirubin encephalopathy (as kernicterus is a pathological term).

☆ Aetiology:

1- Level of serum bilirubin exceeding critical values (10 in 1st day, 15 in 2nd day then 20 mg/dl for hemolytic and 25 mg/dl for non hemolytic). However kernicterus may occur at lower levels than usual if certain factors are present:

* **Factors ↑↑ permeability of BBB:**

- Sepsis
- Hypoxia
- Prematurity
- Acidosis.

* **Factors displace bilirubin from albumin:**

- Drugs (Ampicillin, sulpha, warfarin)
- Hypoalbuminaemia

2- Duration of exposure to the high bilirubin level: The longer the duration the more risk of kernicterus.

☆ C/P:

◎ Acute bilirubin encephalopathy:

Can be divided into three phases:

- 1- Hypotonia, lethargy, poor suckling and high pitched cry! (resembling sepsis or ICH)
- 2- Hypertonia, rigidity, opisthotonus, fever, convulsions and bulged fontanelles.
Many infants die in this phase, all infants who survive develop chronic bilirubin encephalopathy.
- 3- Hypotonia replaces hypertonia after about one week.

◎ Lucid interval:

Usually asymptomatic phase may last weeks to months in survivors from previous stage.

◎ Chronic bilirubin encephalopathy:

- * The full – blown picture of kernicterus (permanent).
- * M.R.I., C.P., dental dysplasia, deafness, choreoathetosis, squint (either all or some of them).

☆ Management:

1- Prophylaxis:

- * Prophylaxis is the main ttt for kernicterus it can be achieved by:
 - TTT of unconjugated hyperbilirubinaemia by the appropriate method (phototherapy, exchange,).
 - Prevention of other risk factors: e.g. sepsis, acidosis, hypoxia,

2- TTT:

- * No ttt for kernicterus, only rehabilitation:
 - TTT of convulsions, chorea, rigidity.
 - Management of MR according to degree (mild/moderate/severe/profound)

Q. How to predict kernicterus?

- 1- MRI brain.
- 2- Brain stem auditory evoked response.

V- BLOOD DISEASES OF THE NEWBORN**NEONATAL ANAEMIA****1- Blood loss**☆ **Aetiology:*** **Prenatal causes:**

- Feto-Fetal transfusion
- Feto-maternal transfusion
- Placenta previa.

* **Postnatal causes:**

- Causes of neonatal bleeding esp. hemorrhagic disease of the newborn (see page 134)
- Frequent sampling.
- Cephalhematoma, subgaleal hematoma and other injuries.

☆ **Investigations:**

- ↓↓ RBC's and Hb
- N. or ↑↑ reticulocytes.
- Normal bilirubin.
- For the cause.

2- Hemolysis* **Immune hemolysis:**

Rh, ABO or minor groups incompatibility "Hemolytic disease of the newborn"

* **Non-immune hemolysis:**

- Hereditary as G6PD↓, α thalassaemia or congenital spherocytosis.
- Acquired as DIC, sepsis or vitamin E deficiency.

- ↓↓ RBC's and Hb.
- ↑↑ reticulocytes.
- ↑↑ bilirubin.
- For the cause.

3- ↓ RBC's production* **Congenital infections*** **Congenital leukemia*** **Congenital pure red cell anaemia**
(Diamond Black Fan syndrome).

- ↓↓ RBC's and Hb.
- ↓↓ reticulocytes.
- Normal bilirubin.
- For the cause.

☆ **C/P:**

- 1- Of anaemia (pallor, irritability,)
- 2- Of the cause.

☆ **Treatment:**

- 1- Treatment of the cause.
- 2- Blood transfusion (20 ml/kg) or packed RBC's transfusion (10 ml/kg) in severe anaemia or blood loss.
- 3- Recombinant human erythropoietin in anaemia associated with prematurity.

N.B.: ⇨

① Normal Hb at birth is 17-20 gm/dl. After birth O₂ saturation in blood ↑↑ so inhibition of erythropoiesis occur till Hb falls to low levels (10-11 gm/dl) at which erythropoiesis is restimulated.

These low levels occur about 6-12 weeks after delivery and called physiological anaemia of infancy.

② Hemolytic disease of the newborn "Erythroblastosis foetalis"

- Hemolysis of neonatal RBC's due to transplacental passage of maternal antibodies active against fetal RBC's.
- It includes Rh, ABO & minor group isoimmunization.

Rh iso-immunization

☆ Pathogenesis:

- 1- 85% of the population are Rh +ve (DD or Dd) i.e. having D antigen in their RBC's. The remaining 15% are Rh -ve (dd).
- 2- Escape of small amount of Rh +ve foetal blood (inherited from Rh +ve father) to the circulation of Rh -ve mother may occur during pregnancy, abortion or at delivery → sensitization of the Rh -ve mother → formation of maternal anti-Rh antibodies (usually of IgG type which cross the placenta) → Destruction of foetal RBC's.
- 3- The first baby usually escape hemolysis as sensitization usually occur near time of delivery (late time to transmit antibodies to the baby), but the 1st baby may be affected if the mother is already sensitized (e.g. previous abortion of Rh +ve foetus or previous transfusion of Rh +ve blood).
- 4- Not every Rh incompatibility leads to hemolysis as:
 - * Some Rh +ve fathers are heterozygous (Dd) so they may have 1/2 Rh -ve offsprings.
 - * Not all deliveries are associated with feto-maternal transfusion.
 - * The ability of Rh -ve mothers to form anti -Rh antibodies are variable.
 - * Associated ABO incompatibility may protect against Rh-incompatibility as entrance of foetal blood group A or B will be rapidly destructed in blood group O mother before stimulation of anti-Rh formation.

☆ Clinical picture: According to severity, different presentations may occur:

- 1- **Hydrops foetalis** (the most severe form) → In utero:
 - * Generalized oedema.
 - * Severe anaemia (pallor) and anaemic heart failure.
 - * Hepatosplenomegaly.
 - * Most cases die in utero or shortly after birth.
- 2- **Icterus gravis neonatorum** (less severe) → At birth.:
 - * Severe anaemia (gradually increase).
 - * Hepatosplenomegaly.
 - * Marked unconjugated hyperbilirubinemia (gradually ↑↑) If not treated urgently → kernicterus.
 - * Untreated cases usually die in the neonatal period.
- 3- **Hemolytic anaemia** (mild form) → Early neonatal:
 - * Mild anaemia
 - * ± splenomegaly
 - * Mild unconjugated hyperbilirubinemia.
 - * The best prognostic type.

☆ D.D:

- 1- Other causes of **neonatal anaemia**.
- 2- Other causes of **neonatal jaundice**.

3- Other causes of **hydrops foetalis** (Generalized subcutaneous oedema, pleural effusion and ascitis) as →

- Severe hemolytic diseases.
- Severe liver diseases.
- Congenital infection.
- Congenital nephrosis.
- Chromosomal anomalies.

☆ **Management of Rh-incompatibility:**

I- During pregnancy:

1- **Screening of all pregnant females for Rh group**

⇒ If Rh +ve → nothing.

⇒ If Rh -ve check father's Rh group (If -ve nothing)

2- **If the mother is Rh -ve and the father is Rh +ve:**

Maternal history

First pregnancy with no previous abortion or blood transfusion.



No interference except giving the mother anti-D injection. (after 28 w. gestation and within 72 hrs after delivery)

Subsequent pregnancies or previous abortion or previous blood transfusion.



Determine IgG titre of anti-Rh in maternal blood by indirect coomb's test at 12-16 w. gestation.



Low titre not rising at serial measures (20, 28, 32, 36 w.)

High titre or rising titre at serial measures (20, 28, 32, 36 w.)

Perform amniocentesis to check bilirubin level in amniotic fluid.



Normal level

Serial assessment of ab-titre and bilirubin

High level

Normal ←

→ Rising

Gest. Age ≥ 34 w.

Gest. Age < 34 w.

⇓
Induction of labour

⇓
Intrauterine intraperitoneal transfusion of O -ve RBC's

II- After delivery:

* Investigations:

The same investigation for indirect (unconjugated) hyperbilirubinemia
 ⇒ see before.

* Treatment:

The same lines for indirect (unconjugated) hyperbilirubinemia (exchange, phototherapy,) ⇒ see before.

ABO iso-immunization

☆ Pathogenesis:

- 1- If the mother is group (O) her blood will naturally contain anti-A and anti-B antibodies which can destruct foetal RBC's if the baby is blood group A or B.
- 2- Anti-A and Anti-B are of IgM type which can not cross the placenta, however in 10-15% of cases these antibodies are of IgG type which can cross the placenta → foetal RBC's hemolysis.
- 3- As the AB antibodies are naturally present (in contrast to anti-Rh), so the first baby may be affected.

☆ Clinical picture:

- Mild neonatal anaemia and jaundice → good prognosis.

☆ Investigations:

- As investigations of Rh-incompatibility after delivery.

☆ Treatment:

- Phototherapy
- Exchange is rarely needed.

NEONATAL BLEEDING*** Bleeding in apparently healthy baby**

- 1- Hemorrhagic disease of newborn.
- 2- Swallowed maternal blood.
- 3- Inherited coagulation defects:
e.g. hemophilia A, B or C and Von Willebrand disease.
- 4- Inherited thrombocytopenia:
e.g. TAR syndrome
(thrombocytopenia absent radius)
- 5- Immune thrombocytopenia:
Due to transplacental passage of maternal antibodies against foetal platelets e.g. maternal SLE.

*** Bleeding in sick baby**

- 1- Consumption coagulopathy (DIC).
- 2- Necrotizing enterocolitis (NEC)
- 3- Surgical emergencies:
e.g. volvulus, intussusception.
- 4- Stress gastric ulceration.
- 5- Severe liver diseases.

Hemorrhagic disease of the newborn

- ☆ **Definition:** Self limited hemorrhagic disorder in early neonatal period due to deficiency of vitamin K dependant clotting factors (II, VII, IX, X).
- ☆ **Incidence:**
 - * About 1:3000 live births.
 - * Preterm more affected > full term.
 - * Breast feeding more affected > artificial feeding (Breast milk is deficient in vit. K)
- ☆ **Pathogenesis:**
 - * Transplacental vit. K is usually depleted by the 2nd day of life while endogenous synthesis of vit. K is delayed to the 5th day due to absence of intestinal bacteria flora which synthesize vit. K in the neonate + immaturity of neonatal liver. So, hemorrhage usually occurs from 2nd – 5th day.
 - * Other causes of vit. K deficiency e.g. prolonged antibiotic therapy or malabsorption may lead to late onset hemorrhagic disease.
- ☆ **Clinical picture:**
 - * Bleeding from different sites (GIT, umbilical stump, urinary or rarely intracranial bleeding).
 - * Resultant anaemia (pallor, irritability,)
- ☆ **Investigations:**
 - * Normal bleeding time and platelet count.
 - * Prolonged clotting time, P.T. and P.T.T.
 - * Deficiency of vit. K dependant factors (II, VII, IX, X).
- ☆ **D.D.:**
 - * Other causes of neonatal bleeding (see before) esp. swallowed maternal blood which can be diagnosed by Apt test (foetal blood contains iHbF which resist denaturation by Alkali opposite to maternal blood which is easily denaturated by Alkali)
- ☆ **Prophylaxis:**
 - * Administration of natural vitamin K 1 mg IM to all neonates at birth.
- ☆ **TTT:**
 - 1- Vit. K1 (natural) 1-5 mg I.V daily ± plasma transfusion .
 - 2- Blood transfusion in severe bleeding to correct anaemia.

VI- GIT PROBLEMS OF THE NEWBORN

NEONATAL VOMITING

☆ Vomiting in doing well baby:

- * Swallowed amniotic fluid.
- * Swallowed maternal blood.
- * Feeding disorders e.g. over feeding, aerophagia.....
- * Cow's milk protein allergy.
- * Gastro-esophageal reflux.
- * Congenital pyloric stenosis.

☆ Vomiting in sick baby:

Surgical problems

- * Congenital intestinal obstruction e.g. esophageal atresia, meconium ileus,...
- * Acquired intestinal obstruction e.g. NEC and intussusception.

Medical problems

- * Infection e.g. septicaemia, pneumonia,.....
- * Increase intra cranial tension e.g. meningitis, ICH,
- * Inborn errors of metabolism e.g. Galactosaemia.

NEONATAL DIARRHEA

1- Non-infective diarrhea:

- * Dietetic causes: overfeeding, concentrated formulac or under feeding "starvation diarrhea"
- * Cow's milk protein allergy.
- * Lactose intolerance.
- * Iatrogenic diarrhea: laxatives given to the baby or the mother (secreted in breast milk).

2- Infective diarrhea: (Uncommon)

- * Bacterial
- * Viral
- * Protozoal

NECROTIZING ENTEROCOLITIS (NEC)

☆ Definition:

Syndrome of acute intestinal necrosis of unknown cause usually affects sick prematures with high mortality rate.

The onset of NEC usually occurs in the 1st 2 weeks of life but can be as late as 3 month of age in VLBW infants

☆ Pathogenesis:

1. Aggressive enteral feeding and immature intestinal host defence mechanisms allow aberrant bacterial colonization and impair the response to bacterial toxins.
2. Inflammatory mediators are produced (tumor necrosis factor, platelet activating factor, prostaglandin and cytokines) triggered by local hypoxia and/or bacterial toxins leading to intestinal injury.
3. Oxygen radicals resulting from local ischemia-reperfusion injury, or produced by activated neutrophils leading to bowel injury.

Organisms implicated are :

- E. coli, Klebsiella, Enterobacter, Pseudomonas, Salmonella, and Clostridia.
- Corona virus, Rotavirus and Enteroviruses.
- Recently coagulase negative staph. and methicillin resistant Staph. that produce toxins.

☆ Risk factors:

- 1- Prematurity → the most important factor for NEC.
- 2- Perinatal asphyxia.
- 3- Polycythaemia.
- 4- PDA.
- 5- Cocaine addicting mothers.
- 6- Cyanotic heart diseases.
- 7- Congenital GIT anomalies.
- 8- Catheterization of the umbilicus.
- 9- Non breast Milk feeding.
- 10- Hypertonic Milk formulae.

☆ Clinical picture:**I- Speticeamic manifestations:**

- 1- Poor feeding and hypothermia.
- 2- Lethargy and depressed reflexes.
- 3- Hypotension and shock.
- 4- Attacks of apnea and acidosis.

II- Abdominal manifestations:

- 1- Bilious vomiting and brown gastric aspirate.
- 2- Abdominal distention and abdominal wall tenderness.
- 3- Ileus "absent intestinal sounds".
- 4- Bloody stool either occult or obvious blood.

☆ Investigations:**1- X-ray abdomen:**

- * Pneumatosis-intestinalis → Gas in the intestinal wall.
- * Gas in the portal vein.
- * Pneumo-peritoneum (gas under diaphragm) → If perforation occurs.

2- Sonar abdomen:

- * Portal venous gas.

3- Laboratory findings:

- * The usual triad is: thrombocytopenia, hyponatraemia and metabolic acidosis.
- * Stool examination for occult blood(Guaiac test)

☆ D.D.:

- * Other causes of neonatal vomiting.
- * Other causes of neonatal bleeding.

Bell staging criteria

1. *Stage I* (suspect) clinical signs and symptoms, nondiagnostic radiographs.
2. *Stage II* (definite) clinical signs and symptoms, pneumatosis intestinalis on radiograph.
 - a) Mildly ill.
 - b) Moderately ill with systemic toxicity.
3. *Stage III* (advanced) clinical signs and symptoms, pneumatosis intestinalis on radiograph, and critically ill.

☆ Prevention of NEC :

- Prevention of prematurity.
- Encouragement of breast feeding to preterm infants.
- Formula with egg phospholipids.
- Oral immunoglobulin preparations containing both IgA, and IgG.
- Prenatal or early postnatal corticosteroid.

☆ Treatment : Depends on severity of the disease:

- Enteral feedings are discontinued and stomach is decompressed with NGT.
- Peripheral IV alimentation.
- Antibiotics according to culture and sensitivity for 14 days .
- Sodium bicarbonate (2 mEq/kg) for acidosis.
- Inotropic drugs as dopamine and dobutamines (3-5 ug/kg/min).
- Ventilation therapy.
- Paracentesis of abdomen.
- Platelets or blood transfusion.
- Surgical intervention if there is perforation

VII- CNS PROBLEMS OF THE NEWBORN

ASPHYXIA NEONATORUM (Perinatal Asphyxia)

☆ Definition:

A state of O_2 deficiency affecting various organs results mainly from failure of the newborn to establish spontaneous regular respiration immediately after birth.

☆ Aetiology:

1- Intrauterine causes:

- * Maternal hypoventilation (e.g. H.F., anaesthesia,)
- * Maternal hypotension.
- * Maternal pre-eclampsia (hypertension).
- * Premature separation of the placenta.
- * Uterine tetany $\rightarrow$ $\downarrow$ placental filling.

2- Intrapartum causes:

- * Obstructed labour.
- * Prolonged labour.

3- Post-natal causes (Uncommon):

- * Severe cong. cyanotic heart diseases.
- * Shock.
- * Severe anaemia.
- * Severe respiratory distress.

☆ Clinical presentations:

- * Various presentations may occur depending on the duration and the severity of asphyxia:

1- General manifestations:

- ✧ Foetal monitoring shows slow, weak heart beats with low scalp pH < 7.2 .
- ✧ Low (Apgar score) after birth with cyanosis and flaccidity.

2- Effect of ischaemia on various organs:

- ✧ CNS: "Hypoxic-Ischaemic Encephalopathy" $\rightarrow$ Sarnat staging for HIE
- ✧ CVS: Hypotension, persistent foetal circulation and HF.
- ✧ Renal: Acute tubular necrosis $\pm$ hematuria.
- ✧ GIT: NEC and perforation.
- ✧ Respiratory: Meconium aspiration and respiratory distress.

$\downarrow$

Stage I	Stage II	Stage III
Irritable	Lethargy	Coma
Normal $\uparrow$ tone	Hypotonia	Flaccid
$\uparrow$ reflexes	Weak	Absent
No seizures	Common	No
Good prognosis	Variable	Poor

☆ Management:

- * Prevention of risk factors.
- * Neonatal resuscitation (see before).
- * Management of complications (H.F., convulsions,

☆ Prognosis:

- 1- Death may occur in severe cases.
- 2- The most dangerous manifestation is hypoxic ischaemic encephalopathy which may be severe enough to cause permanent brain damage e.g. cerebral palsy, mental retardation or epilepsy.

NEONATAL CONVULSIONS

* **Clinical definition:** Paroxysmal involuntary cerebral dysfunction which may be in the form of disturbed consciousness, motor, sensory, autonomic or behavioural functions.

* **Pathophysiological definition:** Uncontrolled neural discharge leads to abnormal conversion of the potential energy of the neurons into kinetic energy.

☆ Aetiology:

1- CNS causes:

- * Hypoxic-ischaemic encephalopathy (HIE) → the most common cause.
- * Bilirubin encephalopathy (Kernicterus).
- * CNS infections (meningitis, encephalitis,)
- * CNS anomalies (cerebral dysgenesis).
- * Intracranial hge (ICH).
- * Neurocutaneous syndromes (Neurofibromatosis, Tuberous-Sclerosis,).

2- Metabolic causes:

- * Hypoglycaemia (< 40 mg/dl)
- * Hypocalcaemia (< 7mg/dl)
- * Hypomagnesaemia (< 1.2 meq/L)
- * Hyponatraemia (< 130 meq/L) or hypernatraemia (> 150 meq/L)
- * Pyridoxine (B6) deficiency.
- * Amino acidopathies (phenyl ketonuria, urea cycle defect, maple syrup urine disease,)

3- Drug related causes:

- * Drug withdrawal e.g. maternal narcotics or heroin addiction
- * Drug causing convulsions e.g. large dose theophylline.

4- Other causes:

- * Familial (AD benign condition).
- * Idiopathic.

☆ Manifestations:

1- Onset of convulsions:

- * 1st day of life: e.g. HIE, Drug withdrawal and metabolic.
- * After the 1st week: e.g. meningitis.

2- Types of convulsions:

- * **Subtle convulsions:** (50%) → alone or associated with other types.

Repetitive:- oral movements (suckling, chewing, ...)

- eye movements (blinking, nystagmus, ...)

- limb movements (pedaling, ...)

or - apnea (associated with ↑ HR in contrast to apnea due to respiratory cause which is associated with ↓ HR).

- * **Tonic convulsions:** Rigid posturing of the body (focal or generalized).

- * **Clonic convulsion:** Rapid alternating contraction and relaxation of muscles (focal or generalized)

- * **Myoclonic convulsions:** Sudden synchronous shock like movements of UL or LL.

- * **Combined** (more than one type): e.g. Tonic-clonic convulsions.

☆ Approach to diagnosis:

*- History:

- 1- Onset, frequency and duration of convulsions.
- 2- Perinatal history: Asphyxia, birth trauma, cyanosis, drugs,
- 3- Family history: Amino acidopathies, previous Rh isoimmunization, familial or Neurocutaneous syndromes.

*- Examination:

- 1- Physical exam: e.g. trauma, signs of infection, kernicterus, congenital head anomalies.
- 2- Neurological exam: e.g. signs of ↑ ICT, meningeal irritation, type of convulsions.

*- Investigations:

1- Investigations for metabolic causes:

- Serum Ca, Mg, Na, glucose,...
- Tests for aminoacidopathies.

2- Investigations for CNS causes:

- CSF for infection & bleeding.
- X-ray & CT skull (trauma, ↑ ICT, hge).

*- D.D.:

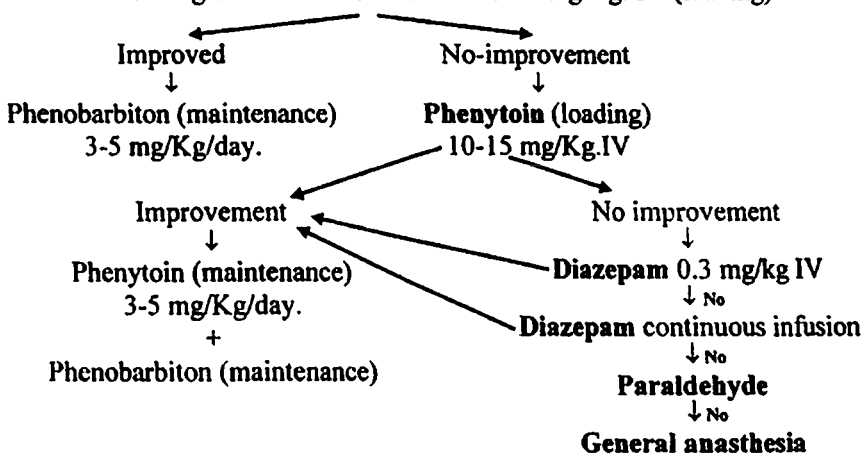
Neonatal convulsions must not be mistaken with **Jitteriness** which is tremor like movement of a limb which can be stopped by holding that limb "opposite to convulsions". Jitteriness is associated with hypoglycemia, hypocalcemia and may occur in normal neonates.

☆ Treatment:

A- Treatment of the attack:

- 1- O₂ therapy, IV fluids & suction of secretions.

- 2- Anticonvulsant drugs: **Phenobarbiton 10-20 mg/Kg. IV (loading)**



B- After controlling the attack:

- 1- Treatment of the cause e.g. Ca, glucose, antibiotics,
- 2- Trial of 50 mg pyridoxine IV is advisable in resistant cases.
- 3- If no response after treatment of the cause or the cause is not found continue on anti-convulsant drugs till complete physical, neurological and EEG examination.

VIII- RESPIRATORY PROBLEMS OF THE NEWBORN

NEONATAL CYANOSIS

☆ Definition:

- * Bluish discolouration of skin and mucus membranes due to presence of more than 5 g/dl reduced Hb in blood.
- * It may be peripheral (not affect the tongue) or central (affect the tongue)

☆ Causes:

1- Cardiac:

- * Congenital cyanotic heart diseases
- * Severe H.F.

2- Respiratory:

- * Causes of severe respiratory distress (see later).

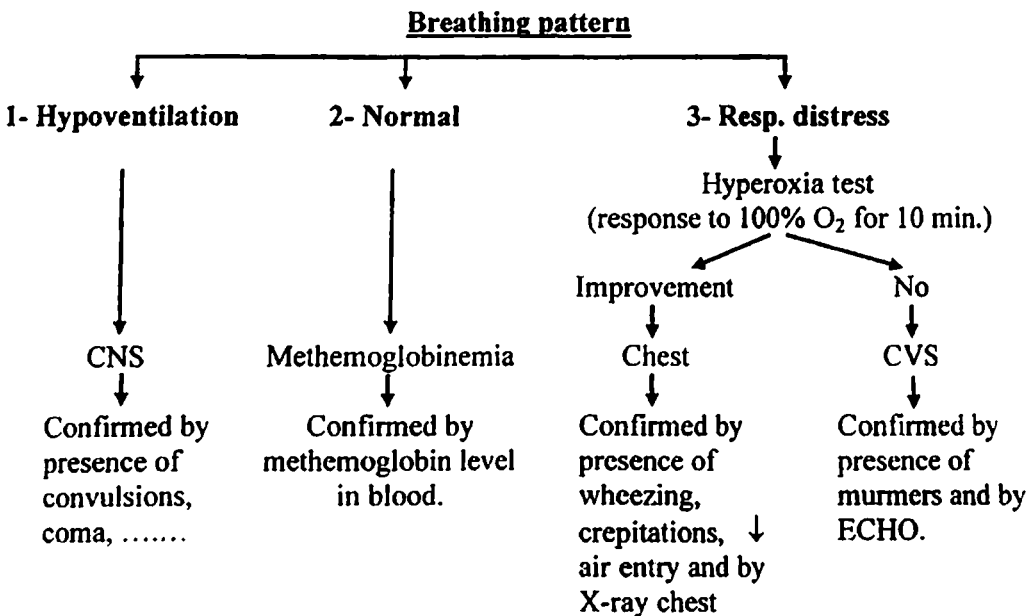
3- CNS:

- * Causes of central respiratory depression (see later).

4- Metabolic:

- * Methemoglobinaemia

☆ D.D. of the cause of cyanosis:



NEONATAL APNEA

☆ **Definition:** Cessation of respiration:

* For any period if associated with cyanosis and bradycardia.

Or * More than 15 seconds with or without cyanosis and bradycardia.

☆ **Causes:**

1- **Apnea of prematurity:**

* Attacks of Apnea in prematures (< 34 week gestation) occurs mainly between the 2nd and the 5th days of life.

* Mechanism:

✧ Central causes (40%): Respiratory center immaturity.

✧ Obstructive causes (10%): Passive neck flexion.

✧ Mixed causes (50%): Due to both central and obstructive causes.

2- **Pathological apnea:**

As respiratory & CNS causes of cyanosis.

☆ **Investigations:** For the cause .

☆ **Treatment:**

1- **Treatment of the cause:**

2- **Treatment of the attack:**

i- Start with → ✧ Avoid neck flexion or extension and oral feeding.
✧ Tactile stimulation.

ii- If no response → ✧ O₂ therapy. ✧ Suction of secretion. ✧ Umbu-bag ventilation
✧ Drugs: (Aminophylline, Caffeine citrate).

iii- If no response → ✧ Mechanical ventilation.

NEONATAL RESPIRATORY DISTRESS

Difficulty of breathing which may be central or peripheral.

NEONATAL CENTRAL RESPIRATORY DISTRESS

☆ **Manifestations:**

- * Slow irregular respiration $\pm$ cyanosis.
 - * Apneic episodes.
 - * Disturbed consciousness $\pm$ coma.
- (It is also called RD due to CNS failure)

☆ **Causes:**

- * CNS anomalies.
- * CNS narcosis (Maternal narcotic drugs or anaesthesia shortly before delivery).
- * CNS damage (ICH, HIE, Kernicterus, Trauma,).

NEONATAL PERIPHERAL RESPIRATORY DISTRESS

- ☆ **Grades of RD:** →
- | | |
|-------------|---------------------------------------|
| Grade (I) | : Tachypnea + working alae nasi |
| Grade (II) | : Intercostal & subcostal retraction. |
| Grade (III) | : Grunting. |
| Grade (IV) | : Cyanosis. |

☆ **Causes of RD:**

i- **Pulmonary causes:**

- * Hyaline membrane disease (infant respiratory distress syndrome).
- * Transient Tachypnea of the Newborn (TTN).
- * Aspiration syndromes (Meconium aspiration, Milk aspiration,).
- * Air leak syndromes (pneumothorax, pneumomediastinum, ...)
- * Pneumonia (congenital or acquired).
- * Congenital lobar emphysema * Pleural effusion.
- * Pulmonary hypoplasia * Pulmonary hgc.
- * Lung cysts * Lung collapse.

ii- **Extrapulmonary causes:**

- * Upper airway obstruction → (Bilateral choanal atresia, macroglossia,)
- * CVS → H.F. (due to severe VSD, PDA, ...)
- * Hematological → Anaemia or polycythaemia.
- * Metabolic → Hypoglycaemia, hypothermia or acidosis.
- * GIT → diaphragmatic hernia, GERD and tracheo-esophageal fistula.

Respiratory Distress Syndrome

"Hyaline membrane disease"

☆ Definition:

A syndrome of respiratory distress occurs in the newborn due to surfactant deficiency. RDS is the commonest cause of neonatal death.

☆ Aetiology:

* Conditions associated with ↓ synthesis of surfactant:

- 1- Prematurity: The smaller the gestational age the higher the incidence of RDS (60% of prematures < 28 weeks gestation develop RDS).
- 2- Infant of diabetic mother: Cortisone is very essential for lung maturity. Very low cortisone level is present in infant of diabetic mother (2ry to hyperinsulinism)
- 3- Cesarian section and precipitate labour: As stress of delivery is essential for surfactant production and enhancement of lung maturation.
- 4- Other risk factors: Perinatal asphyxia / 2nd twin / male sex / ar. ipartum hge.

☆ Patho-physiology:

1- Normally: Surfactant is produced by pneumocytes type II after the 20 weeks of gestation, its main action is to decrease the surface tension within the alveoli to prevent their collapse during expiration.

2- In RDS:

A- ↓ surfactant → ↑ alveolar surface tension → collapse.

B- B- Collapse (atelectasis) → ↓ PaO₂, ↑ PaCO₂ & ↓ pH → vasoconstriction of pulmonary blood vessels → Alveolar hypoperfusion → ↓ metabolism of pneumocytes type II → ↓ surfactant → vicious circle.

☆ Pathology:

- * Macroscopic: The lung is purple in colour, liver like consistency & sinks in water.
- * Microscopic: Extensive atelectasis with eosinophilic membrane lining! alveoli (Hyaline membrane).

☆ C/P:

- * Signs of RD (Tachypnea, grunting,) develop within 12 hours after birth and progressively ↑↑ to reach peak in the 3rd day of life.
- * On auscultation → May be normal, however severe cases show diminished air entry ± bilateral fine basal crepitations.
- * Course →
 - In mild cases gradual improvement occurs from the 3rd day.
 - In severe cases death or complications may occur.

☆ Complications:

- Shock • PDA • Pneumothorax • IVH • Chronic lung disease.

☆ Investigations:

* Prenatal diagnosis

- ✧ Lecithin/sphingomyelin ratio in amniotic fluid →
 - If > 2 → No Risk of RDS.
 - If 1-2 → Risk of RD
 - If < 1 → ↑ Risk of RDS.
- ✧ Saturated phosphatidyl choline in amniotic fluid → If $> 500 \mu\text{g/dl}$ = immature lung.
- ✧ Lamellar body counts in the amniotic fluid have also been used as a rapid and inexpensive test to determine fetal lung maturity.

* Post natal diagnosis:

- ✧ Chest X-ray:
 - Early: diffuse reticulo-nodular infiltrate “Ground glass appearance” + air bronchogram.
 - Late: white lungs “opacification of both lungs”
- ✧ ABG's:
 - Early: ↓ PaO_2 .
 - Late: ↓ PaO_2 + ↑ PaCO_2 + ↓ pH.
- ✧ Shake test:
 - 0.5 ml gastric wash + 0.5 ml alcohol and shake well.
 - Risk of RDS is inversely proportionate to amount of bubbles.

☆ D.D.: Causes of neonatal RD

☆ Management of RDS:

i- Prevention of RDS:

1- Avoid risk factors:

- Avoid unnecessary C.S.
- Control of maternal DM.

2- Maternal glucocorticoid therapy:

- Action → Glucocorticoids ↑↑ surfactant production and accelerate lung maturity.
- Indications → * High risk mothers (< 34 w. gestation)
 - * ↓ lecithin/sphingomyelin ratio in amniotic fluid.
- Contraindications → Chorioamnionitis and maternal DM.
- Dose → Betamethazone 8 mg/8hrs for 24-48 hours before delivery.

ii- Treatment of RDS:

- 1- Incubator care: Every neonate with respiratory distress should be admitted to NICU with frequent monitoring of vital signs, O_2 saturation, ABG's,

2- Supportive measures:

- Respiratory support by O_2 therapy → If persistent low O_2 saturation or cyanosis give continuous positive airway pressure (CPAP) → If no improvement → Mechanical ventilation.
- Feeding support → begin with IV fluids → if oral feeding can't be tolerated within 4-5 days total parenteral nutrition is advised.
- Correction of hypotension or anaemia → whole blood transfusion 10 ml/kg.
- Correction of metabolic acidosis by NaHCO_3 1-2 ml/kg IV.

3- Specific treatment:

- Antibiotics: should be given as it is difficult to differentiate RDS from congenital pneumonia.
- Surfactant ttt: - Either preventive in VLBW after birth or as a therapy for RDS as early as possible.
 - Types of surfactant are human, bovine (Survanta) or synthetic (exocert).
 - Dose 5 ml/kg repeated after 12 hrs through endotracheal tube.
 - Complicated by pulmonary hge.

4- Recent lines:

- Extra-corporeal membrane oxygenation (ECMO).
- High frequency ventilator.
- Nitric oxide therapy.

☆ **Prognosis:** Poor prognosis with lower gestational age (death rate about 50% in neonates < 1.5 kg weight).

Transient Tachypnea Of The Newborn

- * Transient respiratory distress occurs mainly in full term neonates.
- * **Mechanism** → Delayed resorption of foetal lung fluids by pulmonary lymphatic system which occur mainly after cesarean section.
- * **C/P** → • Mild RD occurs within few hours after birth (no grunting or cyanosis)
 - Usually improves spontaneously within 2-3 days.
- * **X-ray chest** → • Prominent vascular markings.
 - Fluid in lung fissures.
- * **TTT (Supportive)** → • O₂ (low concentration) ± IV fluids till improvement

Meconium Aspiration

- * Severe respiratory distress occurs mainly in post mature or full term neonates exposed to severe asphyxia.
- * **Mechanism** → 1- Intrauterine asphyxia → relaxation of anal sphincter → meconium stained amniotic fluid.
 - 2- At birth → meconium aspiration to lungs →
 - Areas of complete bronchiolar obstruction (collapse).
 - Areas of incomplete bronchiolar obstruction (emphysema).
 - 3- 2ry infection of the lungs + chemical irritation
- * **C/P** → • Severe RD with grunting and cyanosis.
 - Meconium staining of nails, umbilicus, limbs,
- * **X-ray chest** → • Hyperinflated lungs ± pneumothorax.
- * **Management at birth** → suction of the mouth and nostrils before taking the first breath. If failed endotracheal suctioning is indicated.
- * **TTT** → • Supportive care, IV fluids, O₂ & ventilation.
 - Death rate > 30%.

IX- ABNORMAL GESTATIONAL AGE AND BIRTH WEIGHT**DEFINITIONS****1- Premature (Preterm):**

⊕ Infant born before 37 w. gestation regardless to his weight.

2- Full term:

⊕ Infant born between 37-42 w. gestation regardless to his weight.

3- Post mature (post term):

⊕ Infant born after 42 w. gestation regardless to his weight.

4- Small for date (small for gestational age):

⊕ Infant with birth weight < 10th percentile of expected from his gestational age.

5- Appropriate for date:

⊕ Infant with birth weight between 10th and 90th percentile of expected from his gestational age.

6- Large for date (Large for gestational age):

⊕ Infant with birth weight > 90th percentile of expected from his gestational age.

7- Low birth weight:

⊕ Any infant < 2.5 kg at birth (either premature 60 % or small for date 40 %)

N.B. • VLBW < 1.5 kg.

• Extremely LBW < 1 kg.

SMALL FOR GESTATIONAL AGE

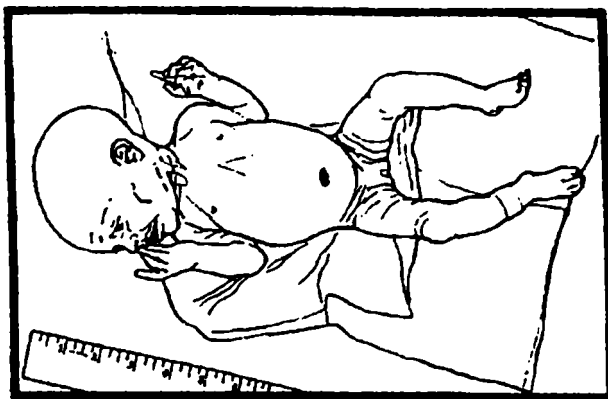
☆ Etiology:

A) *Maternal causes (Placental insufficiency):*

- 1- Placental abnormalities that impair gas exchange and transfer of nutrients as in pre-eclampsia.
- 2- Hypertension
- 3- Chronic heart or kidney disease

B) *Fetal causes:*

- 1- Congenital infection .
- 2- Congenital anomalies and chromosomal abnormalities.
- 3- Twin pregnancy.



☆ Clinical features :

- The infant is active ,alert , hungry with good cry and suckling (opposite to the premature)
- The head is large in proportion to the body size (in asymmetric type)
- Weight is low, length is normal and head circumference is normal (in asymmetric type).
- Skin is loose, dry with scales.
- Subcutaneous fat is decreased.
- Trunk and extremities have less muscle bulk.
- Meconium staining of skin, nails and umbilical cord

N.B: In symmetric type the head circumference is decreased as well.

☆ Complications:

- 1- Pulmonary problems: as asphyxia neonatorum, meconium aspiration and pulmonary hemorrhage.
- 2- Hypoglycemia.
- 3- Hypothermia.
- 4- Hypocalcemia.
- 5- Polycythemia.
- 6- Hyperbilirubinemia.
- 7- Infections.

PREMATURITY

☆ Definition:

Premature (preterm) infant is an infant born at or before 37 w. gestation irrespective to his birth weight.

☆ Aetiology:

I- Idiopathic: The cause of prematurity is unknown in most cases.

II- Maternal factors:

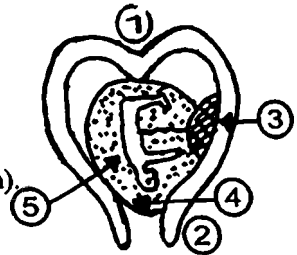
- 1- Low socio-economic class.
- 2- Maternal age < 20 yrs and > 35 yrs.
- 3- Maternal malnutrition during pregnancy.
- 4- Maternal illness during pregnancy (PE, DM, TB, infections, cardiac diseases).
- 5- Maternal drug abuse (e.g. cocaine).

III- Foetal factors:

- 1- Multiple pregnancy.
- 2- Congenital infections.
- 3- Congenital malformations.
- 4- Hydrops foetalis.
- 5- Foetal distress.

IV- Obstetric factors:

- 1- Uterine malformations e.g. Bicornuate uterus.
- 2- Incompetent cervix.
- 3- Placental premature separation (e.g. placenta previa).
- 4- Premature rupture of membrane.
- 5- Polyhydramnios.



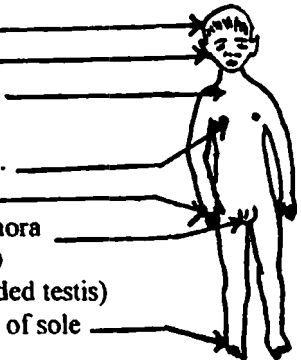
☆ Features of preterm baby:

1- Measurements:

- ✱ Birth weight: < 2.5kg (except infant of diabetic mother).
- ✱ Birth length: < 47 cm (except infant of diabetic mother).
- ✱ Head circumference: < 33cm.
- ✱ Chest circumference: < 30 cm.

2- Physical appearance:

- ✱ Scalp hair → fine and wolly.
- ✱ Ear → shapeless and soft (immature ear cartilage).
- ✱ Skin → pink, shiny, with low S.C. fat and covered by lanugo hair.
- ✱ Breast nodule → < 3mm diameter (or even absent).
- ✱ Nails → Don't reach the finger tips.
- ✱ External genitalia → Female (prominent labia minora not covered by labia majora)
→ Male (retracted or undescended testis)
- ✱ Sole creases → Don't reach beyond the ant. 1/3 rd of sole (or even absent).



3- Physiological features:

- # **Respiration:** → Weak shallow with attacks of apnea due to:
 - Resp. center immaturity.
 - Weak respiratory muscles.
 - Pliable thoracic cage.
- # **GIT:** → Weak suckling, swallowing, digestion and absorption.
- # **Activity:** → Weak crying & activity + hypotonia.
- # **Body temperature:** → Commonly subnormal and unstable due to immaturity of heat regulating center and low S.C. fat.
- # **Physiological jaundice:** → Delayed (after the 3rd day), prolonged ($\pm 2w.$) and deeper ($\pm 15 \text{ mg/dl}$).

☆ Complications (Problems) of prematurity:**1- Respiratory:**

- # RDS (HMD) → (Discuss).
- # Apnea of prematurity → (Discuss).
- # More liable to pul. hge & pneumothorax.
- # More liable to congenital pneumonia.
- # More liable to bronchopulmonary dysplasia (chronic lung disease).

2- CVS:

- # PDA → Heart failure.
- # Hypotension (due to hypovolaemia $\pm$ cardiac dysfunction).
- # Bradycardia (due to apnea).

3- CNS:

- # Kernicterus (bilirubin encephalopathy) → (Discuss).
- # More liable to ICH → (Discuss).
- # Hypoxic-ischaemic encephalopathy → (Discuss).

4- Hematological:

- # More liable to anaemia (Iron $\downarrow$ & Folic acid $\downarrow$).
- # More susceptible to bleeding (Vit. K $\downarrow$ & DIC).

5- GIT:

- # Prematurity is the most important factor for development of NEC → (Discuss).

6- Renal:

- # Immaturity of the kidney → $\downarrow$ capacity to concentrate urine → more liability for acidosis or dehydration.

7- Immunological:

- # More susceptible to infection and sepsis due to deficiency of humoral and cellular response.

8- Nutritional:

- # More liable to anaemia, rickets, PCM, hypoglycaemia and hypocalcaemia due to →:
 - Weak suckling, swallowing, digestion and absorp.
 - High growth rate.
 - Low reserve (e.g. small amount S.C. fat)
 - ↓ Fe, Folic acid, Ca & PO₄.

9- Retro-lental fibroplasia (Retinopathy of prematurity)

- # **Def.:** Vasoproliferative retinal disorder which occurs mainly in premature exposed to high O₂ tension for long duration.
- # **Risk factors:**
 - ↑ O₂ tension for long duration.
 - Vit. E deficiency.
- # **Pathogenesis:** Passes through 4 stages
 - Stage I → V.C. of retinal blood vessels.
 - Stage II → V.D. of retinal blood vessels ± v. erous hge.
 - Stage III → neovascularization of the retina.
 - Stage IV → traction on retina by fibrous tissue → retinal detachment.
- # **Clinically:**
 - No warning manifestations (so screening is needed)
 - Gradual development of astigmatism & retinal detachment.
- # **Treatment:** Mainly prophylactic:
 - Lowest O₂ tension for the least duration is essential if O₂ therapy for prematures is indicated.
 - Vit. E supply.
 - Any premature exposed to prolonged O₂ therapy should be examined by ophthalmoscope at the age of one & three months.

10- Late sequelae of prematurity

- # **Neurological:** MR, spasticity, hearing or visual abnormalities.
- # **Chest:** bronchopulmonary dysplasia, cor-pulmonale.
- # **GIT:** Malnutrition, anemia, rickets, short bowel syndrome.
- # **Social:** FTT, child abuse and neglect.

Management of Low Birth Weight (= of any high risk neonate)

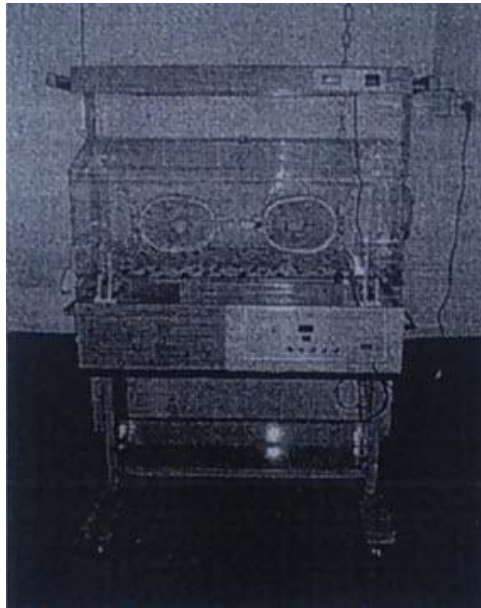
I- Proper ante-natal care:

- * Avoid maternal smoking, irradiation & drugs.
- * Assessment of the foetus by ultrasound
- * In special situation amniocentesis or foetal blood sampling may be indicated.

II- Immediate post-natal care:

- 1- Place the baby under radiant warmer.
- 2- Drying of the baby + suction of secretions.
- 3- Apgar scoring → ± Resuscitation if needed.
- 4- Complete examination (see examination of the newborn).
- 5- Care of the skin and aseptic cutting of the umbilical cord.
- 6- Vit K1 (1 mg IM) is given for all neonates at birth.
- 7- If the baby is large premature (> 2 kg) with no critical illness → discharge home.
- If the baby is below 2 kg weight **or** has a critical illness → **incubator care.**

III - Incubator care:



1- Temperature:

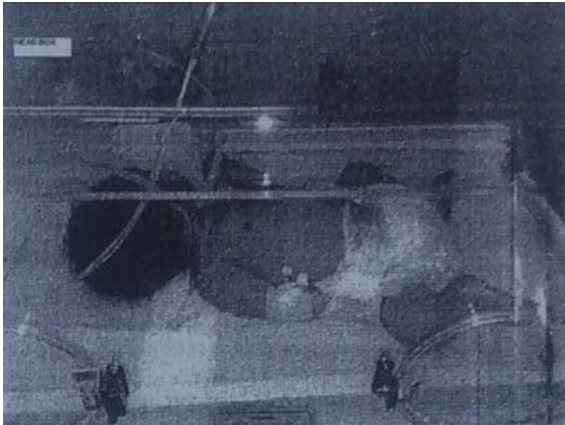
Is adjusted to keep body temperature around normal (36.5-37.2 °C) → so ↓ heat loss & ↓ O₂ consumption.

2- Humidity:

Kept around 40-60% → so ↓ heat loss, ↓ water loss from bronchial tree (prevent dryness of the lungs).

3- O₂ therapy:

- ✧ For VLBW, RD, HIE, Apnea, Cyanosis,
- ✧ Given in the lowest concentration for the shortest period.
- ✧ Excess O₂ therapy in prematures may lead to retinopathy & chronic lung disease.



4- Prevention of infection:

- ✧ All medical personelles must wash their hands before and after examining the baby and no person with infection should be admitted into the nursery.
- ✧ Antibiotic administration if indicated.

5- Feeding:

A- Oral feeding:

- ✧ Type → • Better breast milk or premature artificial milk formula.
- ✧ Routes → • Suckling (In large prematures without respiratory distress).
• Tube feeding through nasogastric tube (In neonates < 1.5 kg or with mild RD)
- ✧ Frequency and amount →
 - Begin with small amount → if no vomiting feeding every 2-3 hrs.
 - With stable condition increase the amount per feed gradually to reach the daily needs (150 cal/k/day)

✧ Vitamin and mineral supply →

- | | | |
|--------------|-----------------|--------------------------------|
| • Vit. K | → 1 mg IM | ⇒ At birth. |
| • Vit. A | → 3000 IU/day | } ⇒ From 2 nd week |
| • Vit. E | → 15 IU/day | |
| • Folic Acid | → 1 mg/day. | |
| • Vit. C. | → 50 mg/day. | |
| • Vit. D | → 1000 IU/k/day | } ⇒ From 2 nd month |
| • Fe | → 2 mg/k/day | |

B- Intravenous fluids:

- ✧ Indications → Severe RD or intolerance to oral feeding.
- ✧ Amount → 60-80 ml/kg/day in 1st day of life with gradual ↑ to reach 150 ml/kg/d in the 5th day.
- ✧ Type →
 - 1st day glucose 10%.
 - After that Glucose 10%: Saline (4:1) + Ca 1-2 ml/kg/day added to the fluids
- ✧ Duration → Maximum for 3-5 days, if oral feeding can't be reassumed total parenteral nutrition must be carried out (IV infusion of amino acids, fat, glucose, vitamins & minerals)

6- TTT of associations:

- ✧ Phototherapy for hyperbilirubinaemia.
- ✧ TTT of PDA (fluid restriction and indomethacin).
- ✧ TTT of infection (antibiotics).

7- Discharge from the incubator:

- ✧ Indications
 - Infant > 1800 grams with good suckling.
 - Maintain his temperature outside the incubator.
 - No critical illness.
 - Normal respiration (No apnea, No RD,)
- ✧ Instructions to the parents
 - To give vaccination according to date of birth (not expected date)
 - To minimize handling and over crowding.
 - To maintain body temperature.

POSTMATURITY

☆ **Definition:** Infant born after 42 week gestation irrespective to his birth weight.

☆ **Aetiology:**

- 1- Unknown → most cases.
- 2- ↑ incidence with trisomies or anencephaly.

☆ **Features:**

- * Face → opened eye and alert baby.
- * Skin → wrinkled, dry with absent lanugo hair ± meconium staining.
- * Nails → long nails.
- * Weight → Average or ↑↑

☆ **Complications:**

- * Perinatal asphyxia ± Meconium aspiration
- * Polycythaemia.
- * Hypocalcaemia.
- * Hypoglycaemia.

X- INFANT OF DIABETIC MOTHER

☆ **Def.:** Neonate born to diabetic mother (true or gestational DM).

Commonly delivered preterm with ↑ birth weight (Large for gestational age).

☆ **Common problems:**

- 1- **Polycythaemia:** Due to ++ erythropoietin 2ry to hyperinsulinism or foetal hypoxia (due to placental insufficiency)
- 2- **Jaundice:** Due to polycythaemia and ↓↓ RBC's life span (2ry to glycosylated Hb).
- 3- **Respiratory distress:** RDS, TTN or cardiac causes.
- 4- **Convulsion:**
Due to:
 - * Hypoglycaemia ⇒ maternal hyperglycaemia → hyperplasia of islets cells of the foetal pancreas.
After delivery and cutting of umbilical cord drop of foetal blood glucose as pancreas continue to secrete ↑ insulin for some time.
 - * Hypocalcaemia ⇒ due to transient hypoparathyroidism & hyperphosphatemia..
- 5- **Cardiac problems:** Cardiomegally & hypertrophic ventricular septum (transient) ⇒ HF.
- 6- **Congenital anomalies** ⇒
 - * Ano-sacral anomalies.
 - * GIT anomalies
 - * Cardiac anomalies.
 - * CNS anomalies (neural tube defect).
 - * Renal anomalies.
- 7- Renal vein thrombosis, manifested by enlarged kidney and hematuria

☆ **D.D.:**

* Causes of neonatal **hypoglycaemia:**

- 1- Hyperinsulinism e.g. IDM, Rh incompatibility, β cell adenoma, Beckwith – Wiedmann syndrome.
- 2- ↓ glycogen stores e.g. starvation, prematurity.
- 3- Metabolic e.g. galactosemia, tyrosinemia & glycogen storage disease.

* Causes of neonatal **hypocalcaemia:**

- 1- Early onset (1st 3 days of life): IDM, prematurity & perinatal asphyxia.
- 2- Late onset: hypoparathyroidism, vit. D. deficiency, hyperphosphatemia, sepsis & shock.

☆ **Management:**

* **The same lines as any high risk neonate** with ttt of specific complications:

- 1- **Hypoglycaemia** must be ttt by glucose 10% 2-4 ml/kg IV followed by glucose 10% maintenance infusion till blood glucose return to normal.
In resistant cases steroids and 1m glucagon are added.
- 2- **Hypocalcaemia** by Ca gluconate 10% 1-2 ml/kg IV.
- 3- **Polycythaemia** by partial exchange transfusion.
- 4- **HF** by inderal (β blocker)
- 5- **Jaundice** by phototherapy.

XI- UMBILICUS

☆ Types of normal umbilicus (navel):

1. **Normal navel:** The skin of abdominal wall meets the umbilical cord at the level of the abdomen.
2. **Amniotic navel:** when the amniotic membrane of the umbilical cord covers the skin surface adjacent to the base.
3. **Skin navel:** when the skin extends up the sides of the cord.

N.B: The amniotic and skin navels are variations of the normal.

☆ Umbilical granuloma:

It is soft, vascular granulation tissue present in the umbilicus and seen after separation of the cord. It is due to mild infection of the umbilicus. The granuloma may ooze seropurulent discharge.

-**Treatment:** cauterization by silver nitrate. If large, surgical removal.

☆ Umbilical polyp:

- A rare anomaly resulting from persistence of all or part of the omphalomesenteric duct or the urachus. The polyp is firm, bright red and has mucoid secretion. It may be communicated with the ileum or the urinary bladder leading to discharge of fecal material or urine.
- Histologically, the polyp is formed of intestinal or urinary tract mucosa.
- **Treatment:** surgical excision of the entire omphalomesenteric or urachal remnant.

☆ Umbilical hernia:

- Due to imperfect closure or weakness of the umbilical ring. It appears as a soft swelling covered by skin that protrudes during crying, coughing or straining and can be reduced easily through the fibrous ring at the umbilicus. The hernia consists of omentum or portions of the small intestine.
- **Treatment:** Most hernias that appear before 6 months disappear spontaneously by the age of 1 year. Strangulation is rare and strapping is ineffective. Surgery is indicated if the hernia persists to the age of 3-5 years, causes symptoms, becomes strangulated or becomes progressively larger after the age of 1-2 years.

☆ Congenital omphalocele:

- It is herniation of abdominal contents into the base of the umbilical cord.
- The sac is covered with peritoneum only without overlying skin.
- **Treatment:** Cover with saline soaked gauze & immediate surgical repair for fear of infection, rupture & dryness of the tissues.

I- EXAMINATION OF THE NEWBORN

1- Quick examination (to detect life threatening insults)

☆ Apgar scoring $\Rightarrow$ (done at 1 & 5 minutes).

☆ Level of consciousness:

- * Normal newborn is conscious, active, alert.
- * Disturbed consciousness as lethargy, coma or weak suckling may indicate cerebral lesion or severe infection.

☆ Colour:

- * Normal newborn is pinkish in colour.
- * Abnormal appearance of the newborn may be:
 - ♦ Pallor (anaemia or shock) ♦ Plethora (Polycythemia)
 - ♦ Cyanosis (Brain, CVS or Resp.) ♦ Jaundice.

☆ Vital signs:

- * Heart rate (120 – 140) $\rightarrow$
 - $\Rightarrow < 100$ bradycardia.
 - $\Rightarrow > 160$ tachycardia.
- * Resp. rate (30 – 40) $\rightarrow$
 - $\Rightarrow > 60$ tachypnea (respiratory distress or acidosis).
- * Temperature (36 – 37.2) $\rightarrow$
 - $\Rightarrow < 35.5$ hypothermia
 - $\Rightarrow > 37.5$ fever.

N.B. After the end of quick exam. the newborn will be considered as:

- $\Rightarrow$ Abnormal $\rightarrow$ resuscitative measures “see later”
- $\Rightarrow$ Normal $\rightarrow$ proceed to other lines of exam.

2- Detailed examination

☆ Measurements:

- * Wt. (3 - 3.5 Kg)
- * Length (± 50 cm)
- * Head circumference (± 35 cm)

☆ Regional examination:

a- Head:

Fontanelles, Eye (e.g. subconj. Hge or hypertelorism), Mouth (e.g. cleft palate), Nose, Ear,

b- Neck:

- * Short neck or webbing (Turner).
- * Goitre (enlarged thyroid).

c- Limbs:

- * Birth trauma e.g. Erb's palsy

- * Malformations.

d- Skin:

- * Meconium staining

- * Oedema (Hydrops fetalis).

e- Genitalia:

- * Ambiguous genitalia

- * Undescended testis.

f- Urine and stool:

- * Normal neonate must pass urine and meconium within 24 hrs after delivery.

☆ Systemic examination:**a- Cardiovascular system:**

- * Apex beat: Normally in Lt 4th space MCL (if in Rt side → dextrocardia).
- * Murmurs: (Most of murmurs in early neonatal period are functional).
- * Femoral pulsations: (If absent, aortic coarctation is suspected).

b- Chest examination:

- * Signs of respiratory distress.
- * Auscultation for wheezes, crepitations,

c- Abdominal examination:

- * For organomegaly, ascitis, umbilicus,

d- Neurological examination:

- * Muscle tone (normally flexed all limbs).
- * Neonatal reflexes → see later.

3- Special examination**☆ Search for congenital anomalies:**

- * Cleft lip * Tracheo-esophageal fistula
- * Limb anomalies * Imperforate anus.

☆ Search of birth injuries: → see before**☆ Assessment of gestational age:**

- 1- From the history (last menstrual period).
- 2- From the ultrasound done during pregnancy.
- 3- From the physical and neurological assessment of the newborn:

- * For each criteria a definite score is given and the net score indicate certain gestational age.
- * A lot of scoring systems are available but Dubowitz score and New Ballard score are the most commonly used.

New Ballard score:

This scoring system is based on :

- a- Neuromuscular maturity :Which is assessed by the posture , square window , scarf sign , arm recoil , popliteal angle and heel to ear test.
- b- Physical maturity :Which is assessed by the skin, lanugo hair , plantar surface, breast ,ear and genitalia.

	-1	0	1	2	3	4	5
Posture							
Square Window	 >90°	 90°	 60°	 45°	 30°	 0°	
Arm Recoil		 180°	 140-180°	 110-140°	 90-110°	 <90°	
Popliteal Angle	 180°	 160°	 140°	 120°	 100°	 90°	 <90°
Scarf Sign							
Heel to Ear							

☺ **N.B. Neonatal screening:**

It is recommended to test all neonates for diseases that have poor prognosis if not detected early and which clinical diagnosis is difficult (e.g. hypothyroidism, phenylketonuria, galactosemia & hemoglobinopathies) by examination of blood sample obtained from heel brick of the neonate.

CHAPTER (IX)

Objective structured clinical examination(OSCE)

An OSCE usually comprises a circuit of short (the usual is 5–10 minutes although some use up to 15 minute) stations, in which each candidate is examined on a one-to-one basis with one or two impartial examiner(s) and either real or simulated patients.

As the name suggests, an OSCE is designed to be:

-objective - all candidates are assessed using exactly the same stations (although if real patients are used, their signs may vary slightly) with the same marking scheme.

-structured - stations in OSCEs have a very specific task.

-a clinical examination - the OSCE is designed to apply clinical and theoretical knowledge. Where theoretical knowledge is required, for example, answering questions from the examiner at the end of the station, then the questions are standardised and the candidate is only asked questions that are on the mark sheet and if the candidate is asked any others then there will be no marks for them.

Module 1: Assessment of the Newborn

STEP/TASK

(Some of the following steps/tasks should be performed simultaneously.)

CASES

Getting Ready

1. Greet the mother and introduce yourself.
2. Tell the mother what you are going to do, encourage her to ask questions and listen to what she wants to say.

HISTORY

(Ask the following questions if data are not available on the mother's/baby's record).

Personal Information:

1. What is your name (mother's name), address and phone number?
2. Age of the mother during pregnancy?
3. What is the name and sex of your baby?

Perinatal history

1- Prenatal history

A- Maternal Obstetric History

1. How many times have you been pregnant (Gravida) and how many children have you got (Para)?
2. How many living children do you have now?
3. Do you have history of abortions/ still births/ neonatal deaths?
4. Are causes of abortion or deaths known?
5. Have you breastfed before?

B- Maternal Medical History:

- 1- Do you suffer from diabetes, hypertension, edema, proteinuria or fits or other relevant diseases during the relevant pregnancy?
- 2- Did you have any infectious diseases as herpes simplex hepatitis B, or TB?
- 3- Ask mother for history of fever, rash, lymph nodes (neck nodules), jaundice, cough or other symptoms of trans-placental infections (Toxoplasmosis, CMV, or German measles)?

4- Ask about history of medications?				
5- Ask about history of exposure to X rays or radioactive materials? (what is the type of radioactive material?)				
2- Natal				
1. Duration of pregnancy.				
2. When was your baby born? (day and hour)				
3. Where was your baby born and who attended the birth?				
4. Did you have fever and/or foul smelling water (amniotic fluid) around the time of delivery?				
5. When did your bag of water rupture? (more than 18 hours before the birth is premature rupture of membranes)				
6. Was the labour or birth difficult or complicated, Comment on: • Fetal distress? • Prolonged labour? • Caesarean section? (elective or selective) • Assisted delivery as Forceps or Ventouse extraction? • Abnormal position and presentation? • Any other complication?				
3- Postnatal				
1. Did the baby cry immediately after delivery?				
2. Did s/he need resuscitation at birth?				
3. Did s/he need oxygen				
4. Did s/he need any NICU care?				
5. Did s/he look bluish (cyanosis)				
6. Ask about jaundice				
7. Did s/he bleed from any opening or below skin				
8. Ask about convulsions				
EXAMINING THE NEWBORN				
A- Assessment of Overall Appearance/Well-Being :				
1. Wash hands thoroughly with soap and water and dry with a clean dry cloth or air dry. (alternatively you can use antiseptic gel)				
2. Place the baby on a clean warm surface or examine him/her in the mother's arms in a well lit environment.				
3. Weigh the baby.				
4- Gestational age assessment Full term or preterm from: • Measurements(Wt, length, OFC) • Physical findings (scalp hair, ear lobule, breast nodule, external				

genitalia, plantar creases)

- | | | | | | |
|-----|--|--|--|--|--|
| 5- | Neonatal reflexes (most important three): (Elicit each and know time of disappearance of each) | | | | |
| | <ul style="list-style-type: none"> • Moro reflex • Grasp reflex • Suckling reflex | | | | |
| 6- | Count the respiratory rate for one full minute | | | | |
| 7- | Observe whether there is nasal flaring, grunting, retractions and/or chest indrawing. | | | | |
| 8- | Assess and count the heart rate in a full minute using a stethoscope. | | | | |
| 9- | Measure the temperature rectally with a personal thermometer | | | | |
| 10- | Observe abnormal colors (cyanosis, jaundice, or pallor) | | | | |
| 11- | Observe activity, movements and posture. | | | | |
| 12- | Assess cry, level of alertness and muscle tone. | | | | |
| 13- | Examine skin (noting any bruises, abrasions and hemangiomas). | | | | |

B- Head, Face, Mouth, Eyes and Nose:

- | | | | | | |
|----|--|--|--|--|--|
| 1. | Examine head (for size, shape, fontanels, and abnormal scalp swellings). | | | | |
| 2. | Examine face, (for abnormal facial features and movements). | | | | |
| 3. | Examine mouth, (tongue, lips, gums, and palate). | | | | |
| 4. | Examine eyes, (for corneal cloudiness, cataract, any swelling, redness, or pus draining from them. | | | | |
| 5. | Perform Doll position | | | | |
| 6. | Examine nose for signs of distress and patency | | | | |

C- Heart, Chest, Abdomen and Cord, and External Genitalia

- | | | | | | |
|----|--|--|--|--|--|
| 1. | Examine cardiovascular system, (HR, heart sounds, murmurs and pulses) | | | | |
| 2. | Examine chest, (shape, gynaecomastia, respiratory movements, auscultation). | | | | |
| 3. | Examine abdomen (distension, concavity or abdominal wall defects, assess the cord stump and count its vessels, palpation for organomegaly or masses, percussion for free peritoneal fluid and auscultation for intestinal sounds). | | | | |
| 4. | Examine genitals noting ambiguity and look for patency of the anus. | | | | |
| 5. | Assess size of penis and examine for descended testes. | | | | |

D- Back and Limbs

1. Examine back, (for any swellings, lesions, dimples, or hairy patches).				
2. Examine all limbs (movements and fractures).				
3. Is there Erb's palsy (by Moro reflex).				
4. Assess hands and feet for Poly and / or Syndactyly				
5. Examine hip joints for limited abduction.				
6. Wash hands thoroughly with soap and water and dry them with a clean, dry cloth or air dry (or alternatively use antiseptic gel) .				
7. Document all your assessment appropriately.				

Module II: Medical History Taking

STEP/TASK

CASES

Getting Ready

- | | | | | |
|---|--|--|--|--|
| 1. Introduce yourself with a friendly greeting. | | | | |
| 2. Give your name and status. | | | | |
| 3. Verify the relationship of the accompanying adult to the child | | | | |
| 4. Explain the purpose of the clinical setting. | | | | |
| 5. Maintain good eye contact | | | | |
| 6. Establish a good rapport with the mother or caregiver, and child. Listen carefully to the mother's complaints. Children above 5 years should be asked to give their history. | | | | |
| 7. Ask for background information (personal history) about the patient: | | | | |
| • Name | | | | |
| • Age, date of birth | | | | |
| • Gender | | | | |
| • Occupation of parents | | | | |
| • Residence (or address for full file requirements) | | | | |
| • Order of birth, consanguinity | | | | |

Presenting complaint

- | | | | | |
|--|--|--|--|--|
| 1. Ask the mother/child about the main problems that made her/him want to see the doctor. | | | | |
| 2. Allow the mother/child to provide an account of recent events in her/his own words without interruption. Describe onset; course; duration | | | | |
| 3. Write down the complaint in chronological order. | | | | |

History of current illness: Analyze the complaint as follows:

- | | | | | |
|--|--|--|--|--|
| 1. Ask about the onset, duration and aggravating and relieving factors. | | | | |
| 2. Ask about other symptoms of the relevant and relating systems (systemic review) | | | | |

STEP/TASK	CASES			
3. Ask about any investigations and their results if done.				
4. Ask about any treatment that have been given				
Past medical history:				
Ask about				
1. Any similar episodes in the past.				
2. Other medical problems or conditions.				
3. Previous hospital admissions.				
History of drug intake:				
1. What medications does the patient actually take for any chronic illness?				
2. History of drug allergy.				
Family history:				
1. Ask about Significant illness in relatives				
2. Similar disease in family.				
3. Comment on consanguinity.				
4. If possible plot the family Pedigree				
SYSTEMIC INQUIRY (inquiry about all the cardinal symptoms in each of the major systems)				
Cardiovascular symptoms				
1. Symptoms of effort intolerance. - Dyspnea on effort. - Interruption of breast feeding to take breathing.				
2. Symptoms of pulmonary congestion. - Dyspnea. orthopnea, paroxysmal nocturnal dyspnea or dyspnea at rest. - Cough. - Hemoptysis.				
3. Symptoms of systemic congestion. - Edema of lower limb. - Pain in right upper abdomen. - Dyspepsia				

STEP/TASK		CASES			
4. Rhythm changes.					
• Palpitation or tachycardia noticed by parents • Syncope.					
5. Cyanosis (continuous or episodic; history of squatting)					
6. Symptoms of low cardiac output.					
• Syncope. • Dizziness. • Easy fatigability. • Cold extremities/blue extremities noted by parents					
7. Symptoms suggestive of rheumatic fever, (as arthritis) infective endocarditis, chest pain, mediastinal symptoms (hoarseness of voice, dysphagia, prayer's position)					
Chest and respiratory symptoms					
1. Cough; timing and type. a. Dry b. Productive					
2. Respiratory difficulty: Dyspnea, fast breathing, or grunting.					
3. Wheezing					
4. Hoarseness of voice and/or stridor.					
5. Chest pain.					
Site.	Duration				
Radiation.	Associated symptoms.				
Character.	Relieving factors.				
Precipitating factors.					
6. Chocking.					
7. Hemoptysis.					
8. Cyanosis.					
9. Toxemic symptoms.					
GI symptoms					
1. Appetite: increased or decreased					
2. Dysphagia.					

STEP/TASK		CASES			
3. Abdominal pain:					
a. Site	b. Radiation				
c. Character	d. Duration				
e. Precipitating factors	f. Relieving factors				
g. Associated symptoms					
4. Dyspepsia, vomiting, or heart burn					
5. Diarrhea, constipation or tenesmus					
6. weight loss / gain.					
7. Hematemesis, melena or fresh bleeding per rectum					
8. Halitosis					
9. Abdominal distension.					
10. Jaundice (yellowish discoloration of skin, <u>conjunctival</u> membranes over the <u>sclerae</u> - and mucus membranes)					
Neurological-symptoms					
1. Motor= Weakness or paralysis					
2. Abnormal movements & convulsions					
3. Parasthesia					
4. Bladder disturbances					
5. Symptoms of increased ICT: Headache, vomiting and blurring of vision					
6. Cranial nerve affection					
a. Anosmia					
b. Diminution of vision					
c. Diplopia					
d. Loss of sensation of the face, difficulty in mastication					
e. Inability to close eye or deviation of the mouth					
f. Tinnitus, deafness or vertigo					

STEP/TASK	CASES			
g. Dysphagia, hoarseness of voice and nasal regurgitation				
h. Dysarthria				
7. Abnormal behavior or disorientation				
8. Convulsions				
9. Hypothalamic manifestations (eating and sleep disturbances)				
10. Gait disturbances				
Endocrine/ reproductive system:				
1. Fatigue.				
2. Polyuria, polydipsia				
3. Weight loss or gain, appetite				
4. Heat intolerance / insensitivity. Irritability, constipation, sleep pattern...				
5. spasms (tetany)				
6. Voice change				
7. Skin change (pigmentation)				
8. Goiter.				
9. Menstrual history, amenorrhoea, secondary sexual characteristics: time of onset, genital abnormalities				
Renal and urinary system:				
1. Urine: color (study different colours), quantity (polyuria or oliguria)				
2. Nocturia, frequency, dysuria				
3. Hematuria				
4. Stones, gravel.				
5. Renal pain.				
6. Colic (site, duration, severity, what increases and what decreases)_				
Skin:				
1. Itching				

STEP/TASK	CASES			
2. Lesions and ulcers				
3. Rashes (Types, distribution, time, course and special march if any).				
4. Coloration				
5. Hair (loss or hirsutism).				
Musculoskeletal system:				
1. Joint pain, stiffness, swelling, and deformity				
2. Relationship of symptoms to rest and exercise.				
3. Limitations of movement.				
4. Bone and vertebral pain.				
Special points in the pediatric history				
1- Developmental history				
• Refer to the schedule of developmental milestones in your Text • Ask about and write down all the developmental items chronologically. • Compare the results with the child's age • Identify whether the child development is normal, delayed or advanced.				
2- Dietetic history				
• Breast feeding : ❖ exclusive or not, (for how long) ❖ regular or on-demand, ❖ one or both sides ❖ how many times per day ❖ Bonding and successful procedure ❖ Post-feeding satisfaction, ❖ Motions, ❖ weight gain ❖ Any problem of breasts ❖ Problems of suckling ❖ Maternal drugs during lactation ❖ When breast feeding stopped • Formula : ❖ Type ❖ Amount ❖ Concentration				

STEP/TASK	CASES
❖ Frequency ❖ Duration of feed ❖ How given (cup and spoon, syringe or bottle). • Weaning: ❖ When started ❖ Types of food used (each food and time of introduction, which preferred and which refused) ❖ How was it given (method, processing and amount) ❖ Any problems during weaning (diarrhea, constipation, vomiting, dysphagia, pain, respiratory or skin allergies, pica, picky nature, anorexia) ❖ 24 hours recall (start from 8 am yesterday till just before 8 am today and record type and amount of food given)	
3- Vaccination history	
• Refer to the child's health card. • If unavailable, ask the mother what the child has received. • Determine any missed or due • BCG during the first month and inspect for the presence of scar. • DPT, oral polio, hepatitis B at 2nd, 4th, and 6th months. • Oral polio + Vitamin A at 9 months • MMR at 1 year • Booster DPT and oral polio (MMR at 18th months if not at 1 year). • Others.	
4- Antenatal, natal, postnatal: refer to newborn module	

Module III: General Examination

STEP/TASK		Cases			
GETTING READY					
1. Pre-exam checklist: WIPE:					
a. Wash your hands and warm them (alternatively use antiseptic gel) .					
b. Introduce yourself to patient or care giver, explain your task.					
c. Position patient [on parent's lap if younger than 6 months age].					
d. Expose area as needed [parent should undress].					
2. Examine from the Right side of the patient (Left-handed can be on left).					
General appearance and facies					
• General condition (fair, ill-looking)					
• Posture, body positions.					
• Abnormal Facies (dysmorphic features facies)					
• Dress, hygiene.					
• Alertness, happiness, Any unusual behaviour					
• Crying: (high-pitched vs. normal. , consolable or non consolable)					
• Parent-child interaction, reaction to other accompanying relatives					
• Ask if tenderness anywhere, before start touching them.					
• If asleep, do the heart, chest and abdominal examination first.					
Vital signs (see specific learning guide)					
Radial pulse. (Appendix 1)		• Apical Pulse. (Appendix 2)			
Other pulses.(Appendix 3)		• Respiratory rate. (Appendix 4)			
Blood Pressure. (Appendix 5)		• Temperature. (Appendix 6)			
Head and neck and Lymph nodes (Appendix 7 & 8)					

STEP/TASK	Cases			
- Colours: - Jaundice - Pallor - Cyanosis (distribution and type)				
Head circumference (did they have serial records to assess rate of growth). (microcephaly, macrocephaly) (Appendix 12)				
Head asymmetry, (brachycephaly, scaphocephaly or acrocephaly).				
Fontanelle, if <18 months: (Full bulging, flat or depressed).				
Scalp hair abnormalities (alopecia, silky, abnormal colour, fragility)				
Thyroid enlargement, other lumps. (appendix 8)				
Neck stiffness.				
Neck lymph nodes as mentioned (appendix 7)				
Neck pulsations as mentioned in Cardiac examination				
Neck veins. (appendix 8)				
Eyes				
Position of examination: Mother holds child on lap facing forward, one arm encircling child's arms, the other hand on child's forehead				
Sunken eyes (dehydration)				
Normal or narrow palpebral fissure				
Epicanthic folds				
Direction (normal, mongoloid slanting or antimongoloid slanting)				
Anatomical location (enophthalmia +/- microphthalmia, exophthalmos, proptosis)				
Strabismus (Apparent Strabismus is normal before 4-6 months).				
Lids (ptosis, coloboma, lashes)				

STEP/TASK	Cases			
• Pupils: reaction to light.				
• Congenital cataracts.				
• Discharge (purulent or non)				
• Conjunctiva (congestion, injection or suffusion)				
• Photophobia,				
• Sclerae, (blue)				
Ears				
• Examination position: same as eye, but child faces the side.				
• Size (Micro or macro-otia)				
• Shape e.g. Bat ears				
• Site (Low set ears)				
• Tags or fistulae				
• Discharge				
• External ear tenderness.				
• Test hearing.				
Nose				
• Nasal Bridge				
• Discharge				
• Nares patency				
• Nasal flaring.				
Mouth (Appendix 9)				
Throat (see also Appendix 9)				

STEP/TASK	Cases			
• Tonsils: size, signs of inflammation, follicles of pus or membrane. • Posterior pharyngeal wall				
Diaper, genitalia, anus (permission is asked verbally)				
• Only perform when indicated.				
• Diaper: ○ Inspect contents. ○ Inspect napkin area				
• Male: ○ Size of penis, Circumcision ○ Epispadias/hypospadias? ○ Testes descent, hydrocele ○ Hernias				
• Female: Vulva, clitoris. 2 openings				
• Both sexes: ○ Tanner stage. ○ Discharge. ○ Abnormalities.				
• Anus inspection: ○ Hemorrhoids, fissures, prolapse. ○ Peri-anal inflammation.				
Extremities and Back				
• Test for hip dislocation in newborn and early infancy (hip abduction in infants with knees flexed especially in girls).				
• Feet abnormalities (as Talipes deformities or rocker-bottom feet).				
• Deformities of bones or joints				
• Poly and or Syndactyly, Arachnodactyly				
• Simian Creases				
• Rudimentary middle phalanx of the little finger				
• Ape-line,				

STEP/TASK	Cases			
• Separation or overlying toes, or hand clenching				
• Nails				
✧ Pallor				
✧ Clubbing				
✧ Hemorrhages				
✧ Spooning				
✧ White spots				
✧ Hypoplasia				
✧ Pits				
• Spine:				
✧ deformity (kyphosis; scoliosis, lordosis)				
✧ masses,				
✧ tenderness,				
✧ limitation of movement,				
✧ spina bifida and				
✧ pilonidal dimple.				
Skin				
• Rashes, using proper terminology.				
• Skin colour,				
• Skin consistency,				
• Hydration (skin elasticity, dryness).				
• Subcutaneous fat.				

STEP/TASK	Cases			
• Oedema,				
• Bruises and petechiae.				
• café-au-lait spots, hemangiomas and nevi,(their size and location).				
Body Measurements at the end of exam				
Height (length below 2 years), weight, skull circumference and MAC (Appendices 10-13)				
Measure and plot on appropriate centile chart.				

Appendix 1: Measuring Radial Pulse

STEP/TASK	Cases			
Getting Ready:				
1. Prepare equipment: Watch or clock with a counter for seconds.				
2. Explain the procedure to the patient.				
3. Assist the patient to pronate and slightly fix the forearm.				
4. Wash the hands				
Procedure:				
1. Locate the radial artery just medial to the distal radius and proximal to the patient's wrist on the thumb side.				
2. Place the tips of the index, middle & ring fingers just proximal to the patient's wrist on the thumb side, orienting them over the vessel.				
3. Push lightly at first, gradually adding pressure till you feel the pulse.				
4. Repeat procedure with other arm to assess equality on both sides				
5. Compare with the apical pulse.				
Post Procedure:				
1. Wash the hands.				
2. Discuss the findings with the patient.				
3. Record the results as beats / minute and comment on regularity and volume.				

During palpation, note the following:

- **Rate:** Measure the rate of the pulse (recorded in beats per minute). Count for 30 seconds and multiply by 2. If the rate is particularly slow, fast or irregular, it is probably best to measure for a full 60 seconds in order to minimize error in recording over shorter periods of time.
- **Rhythm:** Is the time between beats constant? so it may be : (1- Regular. 2- Regular irregularity 3- Irregular irregularity).
if the pulse is irregular; verify the rate by listening over the heart (apical pulse).
- **Volume:** (i.e. the subjective sense of fullness).
 - Normal.
 - Big.
 - Small
 - Variable volume.

▪ **Special character:**

Comment if there is a special character as Water hammer pulse .

Appendix 2: Measuring Apical Pulse

STEP/TASK	Cases			
Getting Ready:				
1. Prepare equipment: Watch or clock with a counter for seconds.				
2. Explain the procedure to the patient.				
3. Assist the patient to a comfortable position (supine or semi-sitting).				
4. Stand to the right of the patient.				
5. Expose chest well.				
6. Wash the hands				
Procedure:				
1. By inspection: look tangentially, from the side of the patient for apical pulsation.				
2. Palpate the apex by palmer surface of the hand.				
3. Localize the apex (the lowermost outermost visible palpable powerful pulsation) with the tip of your index finger.				
4. Auscultate the apex with the bell of the stethoscope.				
Post Procedure:				
1. Discuss the findings with the patient.				
2. Wash your hands.				
3. Record the results as beats / minute				

Appendix 3: Assessment of Peripheral pulses

STEP/TASK	Cases			
Getting Ready				
1. Greet the patient respectfully and with kindness.				
2. Tell the patient you are going to examine the different pulses				
3. Position the patient as suitable for each pulse.				

1. Wash hands thoroughly and dry them					
2. Put on new examination or high-level disinfected surgical gloves on both hands.					
3. Exposure: Ask the patient to remove all clothing covering the examination areas					
Assessment of Peripheral Arterial pulses:					
1. Femoral artery:					
1. Lay the patient supine					
2. Partially flex the knee					
3. Abduct and externally rotate the hip					
4. Using the tips of your fingers					
5. Feel the pulse below the mid-inguinal point					
6. Compare both sides.					
2. Popliteal artery:					
1. The patient to lie supine and partially flex the knees					
2. Feel the pulse with the fingers encircling and supporting the knee on both sides.					
3. <u>Alternate method:</u>					
▪ Ask the patient to lie prone					
▪ Using the tips of your fingers pressing against the femur					
▪ Feel along the line of the artery					
▪ Compare both sides.					
3. Posterior tibial artery:					
1. The patient to lie supine					
2. Using the tips of your fingers					
3. Feel the pulse in the groove between the medial malleolus and tendo-achilles.					
4. Compare both sides.					
4. Dorsalis pedis artery:					
1. Using the tips of your fingers					
2. Feel the pulse lateral to the extensor hallucis longus tendon and proximal to the first metatarsal space.					
3. Compare both sides.					
5. Brachial artery:					
1. Partially flex the elbow					
2. Using the thumb					
3. Feel the pulse over the elbow just medial to the biceps tendon.					

Appendix 4: Measuring the Respiratory Rate

STEP/TASK	Cases
-----------	-------

Getting Ready:

1. Prepare equipment: Watch or clock with a counter for seconds.

2. Assist the patient to a comfortable semi-sitting position

3. Wash the hands.

Procedure:

1. Do not explain the procedure to the patient,

2. Pretend you are measuring the radial pulse, while inspecting and counting the elevations of the chest wall in 60 seconds.

3. If you could not count the respiratory rate easily because of clothes or any other reason, let the patient lie flat and pretend that you are measuring the apical pulse or performing cardiac examination while counting the respiratory rate.

Post Procedure:

1. Wash your hands.

2. Record the results as breathes/ minute and comment on regularity and difficulty.

Appendix 5: Measuring Blood Pressure**STEP/TASK****Cases****Getting ready:**

1. Greet the child and parents.

2. Explain the procedure and attempt to gain the child's and parent's confidence before approaching the child.

3. Explain that the procedure will not hurt.

4. Put the patient in a supine or sitting position with back supported for 5 minutes and legs uncrossed, feet flat on the floor and patient relaxed.

5. Prepare equipment (stethoscope and sphygmomanometer)

6. If the pulses are equal, use right arm.

7. If unequal, use arm with the strongest pulse.

8. Take off the sleeve of the identified arm.

9. Arm should be abducted, supinated & at the level of the heart (if sitting, use arm support).

10. Choose the correct size of the width of the cuff. The bladder at least 40% of the circumference of the midpoint of the upper arm and the length 80% of the

STEP/TASK	Cases
upper arm.	
TAKING THE BLOOD PRESSURE	
1. Place the cuff around the upper arm with the lower edge of the cuff, with its tubing connections one inch above the antecubital space across the inner side of the elbow.	
2. Wrap the cuff snugly around the inflatable inner bladder centered over the area of the brachial artery.	
3. Close the valve of the pump.	
4. Inflate the cuff while palpating the radial pulse. Inflate the cuff rapidly to 70 mmHg then 10 mmHg at time till the pulse will no longer be felt (the pulse obliteration pressure). This is the approximate systolic BP.	
5. Deflate the cuff	
6. Mentally Add 20-30 mm Hg to previously measured number to know the maximum inflation level (MIL).	
7. Place the earpieces of the stethoscope into ears, with the earpiece angles turned forward toward the nose.	
8. Palpate the brachial artery.	
9. Apply the diaphragm of the stethoscope over the brachial artery, just below but not touching the cuff or tubing.	
10. Close the valve of the pump.	
11. Inflate the cuff rapidly to the MIL previously determined.	
12. Open the valve slightly and maintain a constant rate of deflation at approximately 2mm per second.	
13. Allow the cuff to deflate	
14. Listen throughout the entire range of deflation until 10mm Hg below the level of the diastolic reading. The first loud beat will be the systolic recording, the sudden reduction of sound will denote the diastolic reading.	
15. Fully deflate the cuff by opening the valve.	
16. Remove the stethoscope earpieces from the ears.	
17. Write down the systolic and diastolic readings to the nearest 2mmHg.	
18. Deflate cuff completely,	
19. If the sound were not heard clearly or the blood pressure recording is high raise arm above head level for one minute then lower arm and repeat exam.	

Appendix 6: Axillary Temperature Using a Mercury Thermometer

STEP/TASK	Cases		
Getting Ready:			
1. Prepare equipment (thermometer tray, tissue paper and thermometer)			
2. Tell the mother what is going to be done and encourage her to ask questions.			
Procedure:			
1. Place the baby on her/his back or side on a clean, warm surface.			
2. Shake the thermometer until it is below 35°C.			
3. Place the tip of the thermometer high in the apex of the axilla with thermometer parallel to long axis of the body and hold the arm continuously against the body for at least two minutes.			
4. Remove the thermometer and read the temperature by holding it at eye-level and rotating the stem until the mercury is clearly seen			
Post Procedure:			
1. Wipe the thermometer with a disinfectant solution after each use (better use a thermometer for each child).			
2. Record results on a notepad			

NB: Rectal temp is the most accurate one.

Appendix 7: Examination of Lymph Nodes

STEP/TASK	Case		
Getting Ready			
· Greet the patient respectfully and with kindness.			
· Tell the patient you are going to examine the lymph nodes and their sites.			
· Position the patient according to each group of lymph nodes			
· Wash hands thoroughly and dry them			
· Exposure: Ask the patient to remove all clothing covering the examination areas			
Internal Waldayer Ring (see mouth exam)			
External Waldayer Ring			
· Inform the patient or parent what are you going to do			
· Examine both from front and back using both hands			
· Examine for submental LN in midline below chin			

- Examine for submandibular LN on both sides below the mandible
 - Do bimanual palpation with a gloved fingers to differentiate between LN and salivary gland (technique needs to be described)
 - Palpate for the jugulo-digastric LN on both sides below the angles of the mandible. One at a time to avoid bilateral carotid pressure and syncope?
 - Pre-auricular LN
 - Mastoid LN
 - Occipital LN
- 0- Give the following comments
- a. Size
 - b. Site
 - c. Tenderness
 - d. Consistency (soft, firm)
 - e. Matting
 - f. Attachments to overlying and underlying tissue
 - g. Associated lymphangitis
 - h. Catchment area evaluation.

Cervical LN

- Inform the patient or parent what are you going to do
- Inspect and palpate
- Examine from front and back
- Determine whether upper or lower (Transverse line dividing neck)
- Determine whether anterior or posterior (in relation to sternomastoid)
- Determine whether superficial or deep to sternomastoid
- Make the previously mentioned comments

Axillary LN

- 1- Inform the patient or parent what are you going to do
- 2- Examine the patient from the front:
- 3- Examine each axilla with your opposite hand
- 4- Rest the patient forearm on your forearm
- 5- Examine for apical, anterior, posterior, medial, lateral groups of LNs
- 6- You can palpate the posterior axillary fold from behind
- 7- Give the full description for each group on both sides

Mediastinal LN

- 1- Inform the patient or parent what are you going to do
- 2- Auscultate the back in midline and slightly around for bronchial breathing below the level of carina (below 2nd thoracic in infants, below 3rd thoracic in children and below 4th thoracic in adults)

Para-Aortic LN

Mesenteric LN

Lymph Nodes in the Inguinal Region

1. Inform the patient or parent what are you going to do				
2. Fully expose the inguinal region				
3. Lay supine				
4. Flex the contra-lateral knee				
5. Palpate above and below the inguinal ligament				
6. Examine both sides				
7. Examine lower limbs for a cause.				
Epitrochlear Lymph Nodes				
Post-procedure				
• Remove gloves/ wash hands after examination • Inform parent/patient of findings • Thank patient/ parent				

Appendix 8: Examination of the Neck

STEP/TASK	CASES
Getting Ready	
1. Greet the patient respectfully and with kindness.	
2. Tell the patient you are going to examine the neck.	
3. Ask the patient to sit on the examining table with arms at sides.	
4. Wash hands thoroughly and dry them	
5. Put on new surgical gloves on both hands.	
6. Exposure: Ask the patient to remove all clothing down to the nipple line.	
PROCEDURE	
Inspection:	
▪ Observe the contour of the neck and notice any abnormalities	
▪ Ask the patient to swallow and notice any masses moving with deglutition	
▪ Define the anatomical site of any observed swelling	
▪ Notice any neck pulsations, dilated veins, scars	
▪ Allow patient to recline at 45 degrees, this makes normal neck veins visible just above clavicles with their characteristic pulsations	

Comment on:

- Arterial pulsations (suprasternal and or prominent carotid pulsations)
- Venous pulsations; congestion, pulsations and their relation to inspiration
- How to differentiate between venous and arterial pulsations
- Thyroid swelling
- Other swellings
- Webbing of the neck

Palpation:

- | | | | | |
|---|--|--|--|--|
| • Advise the patient to sit on a stool | | | | |
| • Stand behind the patient | | | | |
| • Instruct the patient to relax the neck muscles so as to allow you to move the head in any direction | | | | |
| • Hold the head with one hand and flex it gently to one side while palpating the front of the neck with the other hand | | | | |
| • Flex the patient's head towards the side that is being palpated | | | | |
| • Palpate the trachea and its position | | | | |
| • Examine the relationship of any masses detected to: <ul style="list-style-type: none"> ○ The trachea: Notice the movement of the mass with swallowing ○ The hyoid bone: Notice the movement of the mass with protrusion of the tongue | | | | |
| • Palpate the cervical lymph nodes (revise LN) | | | | |
| • Palpate both carotid arteries for equality and thrill; one at a time | | | | |

Comment on:

- **Thyroid gland:** is there thyroid gland swelling (goiter) (The normal thyroid is not visible & is often not palpable).
 - size
 - shape
 - tenderness
 - mobility
 - consistency
- **Lymph node enlargements**
- **Pulsations and thrill**

Percussion :

- | | | | | |
|--|--|--|--|--|
| <ul style="list-style-type: none"> ▪ Tap with the index finger over the <i>manubrium sterni</i> in order to rule out any retrosternal extension of the thyroid gland, which will elicit a dull note | | | | |
|--|--|--|--|--|

Auscultation:

- | | | | |
|--|--|--|--|
| <ul style="list-style-type: none"> ▪ Listen over the thyroid gland for any bruit or murmur. ▪ Listen over both carotid arteries for any bruit or murmur. | | | |
|--|--|--|--|

Procedure:

- | | | | | |
|--|--|--|--|--|
| 1. Place the child gently on the center of the weighing Scale | | | | |
| 2. Wait till the scale display stops flashing (digital scale), or the pointer settles (mechanical scale). In case you use a beam scale, move the weight on the main scale beam away from the zero point until the indicator settles at the center (The child must not touch the table and the mother must not support his body). | | | | |
| 3. Take the child off the scale and repeat the previous Step | | | | |
| 4. Record the average of both readings | | | | |

Post procedure:

- | | | | | |
|--|--|--|--|--|
| 1. Return the child to his mother and instruct her to dress it him | | | | |
| 2. Record the weight and plot it on a growth chart. | | | | |

Recording weight on the growth chart (plotting measurements)

- | | | | | |
|--|--|--|--|--|
| 1. Write the month of birth in the box below the first vertical column (the first box which has thick lines around it). Near the box, write the year of birth. | | | | |
| 2. Beginning with the month of birth, write out the following months of the year in the following boxes. When you reach January, write the year near that box exactly as you wrote the year of birth near the box for the month of birth. | | | | |
| 3. Carefully calculate the child's age to the nearest month. | | | | |
| 4. Record the weight by putting a big dot on the line corresponding to that weight in kilograms. For example, if the weight is 6 kg in a given month, find the horizontal line representing 6 kg and put a dot at the point on that line where it meets the column for the month in which the weight is being taken. <i>Use a straight edge to draw a horizontal line from that point until the vertical line.</i> | | | | |



- | | | | | |
|---|--|--|--|--|
| 5. Adjust the position of the dot within a column. If the child is being weighed early in the month, put the dot towards the left side of the column. Put the dot | | | | |
|---|--|--|--|--|

in the middle of the column if the weight is being taken in the middle of the month. If the weight is being taken late in the month, put the dot towards the right side of the column.				
6. Follow the above instructions each time you record the weight on a chart. Join subsequent dots by a line. This is the growth curve				
Interpreting the growth line (revise your Text)				
Counseling the mother about her child's growth				
1. Tell the mother the difference in her child's weight compared to the previous month. <i>Is this normal or less (malnutrition) or excess (overweight or obesity)</i>				
2. Ask the mother open-ended questions (related to her child's feeding practices) and write down your notes.				
3. Compliment the mother for what she is doing correctly and counsel her on any problems identified during the diagnosis. Urge the mother to continue the things she is doing correctly and change faulty behaviours.				
4. Ask the mother what things that would make it difficult for her to follow the advice that she is given and help the mother to work through any obstacles				
5. If the child has been ill, talk about prevention or management of the illness.				
6. Verify that the mother understands the advice asking her to mention the key things that she should stop doing and the things she should continue to do.				

- Weight above 2 years: standing undressed (underwear's) on a calibrated scale

Appendix 12: Measurement of the Head Circumference

STEP/TASK		CASES			
Getting Ready:					
1. Prepare a non-stretchable measuring tape					
2. Introduce yourself to the mother					
3. Ask her permission to examine the child					
Procedure:					
1. Patient position? Preferably sitting supported by mother if necessary					
2. Pass the tape on the forehead along the plane midway between the eyebrow and the hairline, to the occipital prominence at the back of the head.					
3. Take care of kinks or obliquity-					
1. Measure to the nearest millimeter					
2. Repeat three times and take the average					
Post procedure:					

Record measurement on head circumference chart

--	--	--	--

Appendix 13: Measurement of Mid-Arm Circumference

STEP/TASK				CASES
Getting Ready:				
1. Prepare the following tools:				
• A non-stretchable measuring tape				
• A water removable skin marker				
2. Introduce yourself to the mother				
3. Ask her permission to examine the child				
4. Ask the mother to undress the child exposing the left shoulder and arm.				
5. Help the child put the arm in an extended relaxed position				
Procedure:				
1- Identify the mid-point between the acromion and the olecranon on the lateral side of the left arm.				
2- Pass the tape around the arm at the identified plane, perpendicular to the long axis of the arm				
3- Measure to the nearest millimeter				
Post procedure:				
Record the reading – interpretation				

Module IV= System Examination (see Appendices 14, 15, 16 and 17)

1-Abdominal Examination

GETTING READY

- | | | | | |
|--|--|--|--|--|
| 1. Greet the patient respectfully and with kindness. | | | | |
| 2. Explain the procedure to the patient. | | | | |
| 3. Ask the patient or care giver to undress from the nipple line to the mid-thigh, and cover with a clean sheet. If this is embarrassing, examine the genitalia first and then cover them before examining the rest of the abdomen. | | | | |
| 4. Wash hands thoroughly and dry them (alternatively use antiseptic gel). | | | | |
| 5. The patient's position: ask the patient to lie flat on his back with the legs extended. <i>Older children need to flex the hips to 45° and the knees to 90°. (In very young infants you can examine the infant in the mother's lap).</i> | | | | |

INSPECTION:

- | | | | | | |
|---|-----------------------------|--|--|--|--|
| 1. Look from end of the bed and tangentially and observe: | | | | | |
| a. Abdominal movements with respiration | f. Divercation of recti | | | | |
| b. Breasts | g. Scars or pigmentations | | | | |
| c. Pulsations (Epigastric pulsations) | h. Veins. | | | | |
| d. Hernias | i. Visible peristalsis. | | | | |
| e. Umbilicus | j. Genitalia – Tanner stage | | | | |

PALPATION:

- | | | | | |
|--|--|--|--|--|
| 1. Stand by the right side of the patient (unless you are left handed) | | | | |
| 2. Make sure that your hand is warm and ask the patient to flex the hips and knees in order to relax the abdomen. (not needed in very young) | | | | |
| 3. Ask the patient whether there is a painful area or a mass. Always start palpation in the region diagonally opposite to any lesion or pain, and proceed systematically to other regions approaching the affected area last of all. | | | | |
| 4. Begin in the left iliac fossa and proceed to left lumbar, left hypochondrium, epigastrium, umbilical, suprapubic, right iliac fossa, right lumbar and lastly right hypochondrium . Then palpate more deeply | | | | |

in the same areas.

Superficial palpation:

a. Tenderness:

b. Rigidity:

c. Swelling: (relation to diaphragm and if intra or extra abdominal)

d. Hernia orifices: Examine the anatomical sites of hernia for swelling (repeat while standing)

e. Dilated veins: Determine the direction of the flow by placing two fingers on the vein, sliding one finger along the vein to empty it and then releasing one finger

Deep palpation:

Start palpation of the normal solid viscera (the liver, the spleen and the kidneys):

NB: Liver, spleen: <6 years may palpable up to 2cm below costal margin.

A. Palpation of the liver:

- Place your right hand on the right iliac fossa (MCL) resting transversely parallel to the costal margin
- Ask the patient to take a deep breath.
- Keep your hand still during inspiration
- As the patient to expire, slide the hand a little nearer to the right costal margin till you palpate lower border of the right lobe of the liver.
- Put your hand in the midline and repeat the above steps till you palpate the lower border of the left lobe of the liver.
- Percussion is done to get the upper border of the liver. Is liver ptosed?

Record the findings:

- The degree of enlargement (span in cm between upper and lower borders in MCL)
- The character of the border (sharp or rounded).
- The surface (smooth or nodular)
- The consistency (soft like a lip, firm like a nose, hard like a bone or heterogeneous)
- The presence of pulsations
- The presence of tenderness
- Hepatojugular (abdominojugular) reflux

B. Palpation of the spleen:

Start palpation from the right iliac fossa with the tips of your hand directed towards the left axilla, and moving toward the left hypochondrium until you feel the spleen

Record the findings:

- The consistency
- The degree and direction of enlargement
- The character of the border (sharp or rounded), the presence of notch
- The surface (smooth or nodular)
- Tenderness

C. Palpation of the kidneys:

1- Bimanual palpation of both kidneys

- Put your hand behind the patient's loin
- Lift the loin and the kidney forward.
- Put the other hand on the lumbar region and ask the patient to take a deep breath.
- During expiration push your hand deeply but gently and keep it still during inspiration
- Repeat as the patient takes his breath.

2- Ballottement is done to confirm renal origin of a swelling (by pushing renal angle upwards, and palpate the kidney by the other hand)

Comment on: 1- Mass or fullness 2- Tenderness

D. Palpate for other Abdominal Swellings:

Differentiate intra abdominal from parietal swellings:

- Relation to the costal margin.
- Behavior on contraction of the abdomen.

PERCUSSION:

- Rub your hands together and warm them up before placing them on the patient
- Percuss for ascites and over any masses.
- In the abdomen only light percussion is necessary.
- Start from resonant to dull in the midline

A. Percussion of the liver (span of the liver):

- Determine the upper border of the liver by heavy percussion starting from the 2nd intercostal space opposite the sternocostal junction
- Percuss down along each inter-costal space in the MCL and when you reach the dullness ask the patient to take a deep breath and hold it
- Percuss again, ((tidal percussion)), if it became resonant this will denote infra

diaphragmatic cause (liver). If it remain dull, this will denote supra diaphragmatic cause (pleural effusion)

- Measure the distance between the upper border (by percussion) and lower border (by palpation) in the right mid-clavicular line, this is the span of the liver.

B. Percussion of the Spleen:

- Percussion of the Traube space {Area defined by the anatomical apex (5th ICS in MCL), left sixth and eighth ribs superiorly, the left midaxillary line (9th, 10th & 11th ICS) laterally, and the left costal margin inferiorly}.
- If Traube area is dull: the spleen may be enlarged, full stomach, pulmonary or pleural disease or cardiac dullness.

C. Percussion for Ascites (Shifting Dullness)

- Instruct the patient to lie in the supine position
- Place your fingers parallel to the flanks. Start percussion from the region of the umbilicus down to the flank till you elicit a dull tone.
- On detecting dullness, ask the patient to turn to the opposite side, while keeping the examining hand over the exact site of dullness. Keep your hand in position till the patient rests on the opposite side. Repeat percussion; if the flank returns a resonant note and percussion at the umbilicus returns a dull note, that indicates the presence of moderate free ascites.
- Testing for MINIMAL ascites in the knee elbow position: (If shifting dullness is negative) Percuss around the umbilicus while the patient is kneeling in the knee-elbow position.

In case of MASSIVE ascites:

1-Detect ascites by FLUID THRILL:

- Instruct the patient to lie in the supine position
- Place one hand flat over the lumbar region on one side
- Get the patient (or assistant) to put the edge of the hand in the midline of the abdomen
- Tap or flick the opposite lumbar region: A thrill will be felt in the other hand

2- Detect organomegaly by DIPPING method:

- Place your hand in the right hypochondrium and push the abdominal wall downwards by a quick pushing movement from the wrist. An enlarged liver will rebound and hit your hand.
- Place your hand in the left hypochondrium and push the abdominal wall downwards by quick pushing movement from the wrist. An enlarged spleen will

rebound and hit your hand.

AUSCULTATION: for intestinal sounds

- It is performed before percussion or palpation as vigorously touching the abdomen may disturb the intestines, perhaps artificially altering their activity and thus bowel sounds.
- Exam is made by gently placing the pre-warmed (accomplished by rubbing the stethoscope against the front of your shirt) diaphragm on the abdomen and listening for 15 or 20 seconds. Practice listening in each of the four quadrants. Normally, peristaltic sounds are heard every 10 to 30 seconds. Comment on presence intestinal sounds

EXAMINATION OF THE BACK

- Ask the patient to sit
- Inspect for any swellings, deformities or scars
- Palpate for edema over the sacrum
- Palpate for tenderness over vertebrae

EXAMINATION OF GENITALIA AFTER PERMISSION

Comment on descended testes and if any ambiguity

Chest Examination

STEP/TASK	CASES			
Getting Ready:				
1. Wash your hands.				
2. Stand to the right of the patient's bed				
3. Prepare your stethoscope with bell (cone) and diaphragm				
4. Explain the procedure to the patient.				
5. Be sure that your hands are warm if not, rub your hands.				
6. Put the patient in sitting position first.				
7. Ensure good lighting.				
Position of the Trachea by Inspection and Palpation:				
• Place the patient's chin in neutral position.				
• Examine from the front.				

- Gently thrust the index or the middle finger into the suprasternal notch exactly in the midline and try to feel both the sides of the trachea.

NB. (If the finger moves more easily to one side than the other; it means that the trachea is shifted to the opposite side).

Examination of the Chest Anteriorly:

Inspection:

1. Put the patient in supine position.
2. Expose the chest well.
3. Always compare both sides.
4. Examine the chest wall from front, sides (tangentially) and from foot end.

Comment on:

- Respiratory rate
- Shape of the chest
- Symmetry of the chest wall
- Respiratory movements during deep breathing
- Contraction of accessory muscles of respiration (alae nasi, sternomastoids, scalenii, trapezii and intercostal muscles).
- Breasts; Tanner stage.
- Swelling at the costochondral junctions or elsewhere.

Palpation:

1. Ask the patients to take deep breath.
2. Ask patient to repeat "four-four" in Arabic or "Nine -Nine" in English.
3. Use the palm of the hand.
4. Palpate all areas sequentially (three levels anteriorly; infraclavicular, mammary and inframammary and two areas laterally; upper axilla and lower axilla).
5. Compare the corresponding area of the opposite side.

Comment on:

- Chest movement and expansion
- Palpable wheeze
- Chest expansion
- TVF (tactile vocal fremitus);

Percussion:

1. Place your left hand on the right side of the chest wall with pleximeter parallel to the border being percussed.				
2. Strike the center of the second phalanx of the middle finger (plessor) sharply with the tip of the pad of the right middle finger with the movement coming from the wrist joint				
3. Start from resonant to dull area.				
Comment on: Any area of dullness(dull or stony dull) or hyperresonance over the lung fields				

Auscultation:

1. Use the bell (cone) in small children and with the diaphragm in older children.				
2. Ask the patient to breathe deeply with his/her mouth kept wide open.				
3. Auscultate all areas of the lungs anteriorly and laterally.				
4. Always compare both sides.				
5. Ask patient to cough during auscultation.				
6. Ask the patient to say four four in Arabic repeatedly (VR) or nine nine in English.				
7. Auscultate all areas sequentially.				
8. Immediately compare the corresponding area of the opposite side.				

Comment on:

- Type of breath sound (bronchovesicular or bronchial)
- Adventitious sounds as rub or rhonchi (sibilant or sonorous)
- Normal, increased or decreased vocal resonance.
- Presence of bronchophony, whispering pectoriloquy

NB: Normal breath sounds are bronchovesicular and inspiration is twice as long as expiration in young children; breath sounds are vesicular and inspiration is three times as long as expiration in older children.

Examination of the chest posteriorly:**Inspection:**

Comment on: as mentioned anteriorly + Deformity of the spine (kyphosis, lordosis or scoliosis)

Palpation: Comment: as mentioned anteriorly

Percussion: Comment: as mentioned anteriorly

Ausculatuaion: Comment: as mentioned anteriorly

Post procedure:

1- Wash your hands or use antiseptic gel				
2- Explain results to the patient if appropriate				
3- Record them on a notepad				

Cardiac Examination

STEP/TASK	CASES			
Getting ready:				
1- Wash your hands or use antiseptic gel.				
2- Stand to the right of the patient's bed.				
3- Explain procedure to the patient				
4- Prepare a stethoscope with bell and diaphragm				
5- Be sure your hands are warm, if not, rub your hands				
6- Put the patient is in supine position or semi sitting if he is orthopenic .				
7- Ensure good Light.				
8- Expose the patient's chest well and neck.				
Inspection of the precordium:				
1. Look tangentially from the foot end of the patient for precordial bulge.				
2. Look tangentially, from the side of the patient for apical pulsation and other pulsations in: Suprasternal area, Aortic area, Pulmonary area, Parasternal area, Epigastrium				
3. Comment on:				
• Precordial bulge or any other thoracic cage abnormalities				
• Site of apex beat				

- Other pulsations : as
 - Pulmonary area
 - Parasternal area
 - Epigastrium

Palpation of the precordium:

1. Palpate apex by palmar surface of the hand.
2. Localize the apex (the lowermost outermost powerful pulsation) with the tip of your index finger.
3. Palpate other cardiac areas
4. Comment on:

A- Apex:

- Site
- Character
- Thrill
- Palpable gallop
- Dullness outside the apex as a sign of pericardial fluid

B-Palpable diastolic shock

C-Parasternal thrill or heave

D-Epigastria pulsations

E- Carotid pulsations and thrills

Auscultation of the precordium:

1. First auscultate mitral area= apex (fifth left intercostal space).
2. Then auscultate at the axilla.
3. Then auscultate at tricuspid area (lower left sternal border).
4. Then auscultate at the left sternal border.
5. Then auscultate at the second aortic area (third left intercostal space).
6. Then auscultate at the pulmonary area (second left intercostal space)
7. Then auscultate at the first aortic area (second right intercostal space).
8. Move the stethoscope to the neck
9. Move the stethoscope to the interscapular region

Some tips				
1. Detect timing with the carotid pulse.				
2. Use the diaphragm for high pitched sounds (S1, S2, MR, AR and rub).				
3. Use the cone (bell) for low pitched sounds (S3, S4 and MS).				
4. Ask the patient to roll onto his left side and auscultate the apex with the bell.				
5. Ask the patient to sit up, lean forward, exhale completely and hold breath in expiration. Listen to aortic areas down the left sternal border to the apex.				
6. While the patient is sitting evaluate the splitting of the second sound in the pulmonary area (second left intercostal space)				
Comment on:				
A- First and second heart sounds				
B- Additional sounds (third and fourth heart sounds, opening snap of mitral stenosis, ejection click of aortic stenosis; midsystolic click of mitral valve prolapse).				
C- Presence of murmur. If present comment on:				
• Timing : systolic or diastolic				
• Character: early systolic, pansystolic, decrescendo, ejection				
• Site of maximum intensity				
• Propagation				
• Pitch: soft, harsh, musical				
• Intensity and grade				

Neurologic Examination

Getting Ready:

- Establish rapport with the patient
- Explain the procedure to the patient
- Ask the patient to tell if any pain or embarrassment is caused by the examination
- Ask the patient to expose the area of examination
- Compare opposite sides
- Compare distal and proximal sites

- Record findings at the end of the procedure
- Wash hands and maintain proper infection prevention practices.
- Prepare hammer, pin and cotton piece

I- Mental Status Examination

A. Appearance:

B. Movements: (gait, posture, coordination, eye movement and facial expression)

C. Level of Alertness: *Apply Glasgow Coma Score(modified one for children)*

D. Orientation (Awareness of the Environment)

E. Speech:

II- Sensory Examination

(In a young child or uncooperative patients, it is often only possibly to comment that the patient could appreciate pain at the tested dermatomes (Bear in mind the sensory segmental dermatomes).

1. Superficial sensation

A. Pain

1. Use a suitable object to test "sharp" or "dull" sensation (an object that has a sharp part and a dull part as a sharp pin with large head

2. Compare both sides

3. Compare from above down (sensory level)

4. Examine around the trunk or limb in levels

B. Touch

C. Temperature

2. Deep sensation

A. Pressure Sense

B. Vibration Sense

C. Joint sense (joint movement and joint position): With the patient's eyes closed ask the patient to identify the direction you move the toe/finger

3. Cortical Sensation:

Tactile Localization, Tactile Discrimination and Stereogenesis

{Tactile Localization: Ask the patient to localize one point of pin prick}

{Stereogenesis: Ask the patient to close eyes. Place a familiar object in the patient's hand (coin, paper clip, pencil, etc.). Ask the patient to tell you what it is}

III- Motor Examination**1. Examine and observe:**

• Muscle state

• involuntary movement or fasciculation

2. Examination of the muscle tone:

• Ask the patient to relax and not attempt active movement (Wait till a young or uncooperative patient is relaxed and not fighting you)

• Flex and extend the patient's fingers, wrist, elbow, and shoulder.

• Flex and extend patient's ankle, knee & hip. There is normally a small, continuous resistance to passive movement

• Elicit postural reactions: Traction response, vertical and horizontal suspension in young infants

• Observe for decreased (flaccid) or increased (rigid/spastic) tone

• Comment on trunkal and appendicular tone and distribution of tone changes.

3. Examination of the muscle power:

• Test strength by having the patient move against your resistance

• Examine power of muscle around all joints

4. Deep reflexes

a. Ensure that the patient is relaxed and positioned properly before starting

b. Reflex response depends on the force of your stimulus.

c. Reflexes are either normal, hypo or hyper

d. Examine the following reflexes

• The brachioradialis reflex (C5,6)

• The triceps reflex (C6,7)

1. Support the upper arm and let the patient's forearm hang free

2. Strike the triceps tendon above the elbow with the broad side of the hammer				
3. If the patient is sitting or lying down, flex the patient's arm at the elbow and hold it close to the chest				
4. Watch for contraction of the triceps				
• The biceps reflex (C5,6)				
1. The patient's arm should be partially flexed at the elbow (120 degree) with the palm down				
2. Place your left index finger firmly on the biceps tendon				
3. Strike your finger with the reflex hammer				
4. You should feel the response even if you can't see it				
• The knee jerk reflex (L2, L3, L4)				
1. Ask the patient to allow the leg to hang down, or to cross the leg to be examined over the other leg (thighs must be exposed).				
2. Alternatively, Support the half bent knee on your left arm, while the patient is supine				
3. Tap the tendon of the quadriceps just below the patella with the hammer				
4. Note contraction of the quadriceps and extension of the knee				
• The ankle jerk reflex (S1, S2)				
1. Put ankle over the other leg with slight ankle dorsiflexion and eversion (with the other hand).				
2. With the hammer in the other hand & swing it to hit the Achilles tendon				
3. Watch and feel for plantar flexion at the ankle				
• The ankle clonus (S1, S2)				
1. Support the knee in a partly flexed position				
2. With the patient relaxed, quickly dorsiflex the foot				
3. Observe for rhythmic oscillations of the patient's foot				
5. Superficial reflexes				
• Insure that the patient is relaxed before starting • Reflexes can be reinforced by having the patient perform isometric contraction of other muscles (clenched teeth) • Use a blunt object such as a key or tongue blade				
• The abdominal skin reflex (T8, T9, T10, T11, T12)				
1. Strike the abdominal skin rapidly and not too hard with a needle from the side to the middle at three levels				
2. Note the contractions of the abdominal muscles and deviation of the umbilicus towards the stimulus (degree and symmetry).				
• The Planter reflex (S1, 2)				
1. Expose the patient's feet				

2. Press the lower leg against the table.				
3. With a blunt object strike the lateral edge of the sole of the foot from the heel to the base of big toe, heavily, steadily and slowly				
4. Note movement of the toes, normally flexion (withdrawal)				
6. Tests for coordination (<i>Occasionally in a young or uncooperative patient you can only comment on presence of tremor on reaching for objects</i>).				
• Standing: Check whether he could remain straight with eyes opened then with eyes closed.				
• Walking: comment on type of gait				
• Finger-to-nose test				
1. Ask the patient to stretch one arm out				
2. Ask the patient to close his/her eyes				
3. Ask the patient to bring the index finger to the tip of the nose				
• knee-heel test				
IV- Cranial Nerves Examination				
1- Olfactory nerves (CN 1)(may not be needed and difficult in very young patients)				
2- Optic nerve (CN 2) (you can get the help of an ophthalmologist in some cases)				
• Visual acuity:				
• Visual field				
✓ Stand 50 cm in front of the patient and at the same level				
✓ Ask the patient to look directly and fix his eyes into your eyes				
✓ Cover non-tested eyes				
✓ Use small object (or index finger) and place it half distance between you and the patient and beyond limits of field of vision				
✓ Advance the object (while moving) from outwards inwards				
✓ Test the four quadrants (upper nasal, lower nasal, upper temporal, and lower temporal)				
✓ Repeat for the other eye				
• Pupillary reflex				
✓ Shine a bright light obliquely into each pupil in turn				
✓ Look for the change of pupil size in the same eye (direct reflex)				
✓ Record pupil size and any asymmetry or irregularity				
3- Oculomotor, trochlear and abducent nerves (CN 3, 4 and 6)				
• Look for ptosis				
• Squint				
• Nystagmus				
• Pupillary reflex				

4- Trigeminal nerve (CN 5): Organize your approach into three categories:

- Motor
 1. Palpate the temporalis and masseter muscles bilaterally
 2. Ask the patient to open his/her mouth then against resistance from your hands placed below the chin
 3. Notice any deviation of the mandible
 - Sensory: facial sensation
 - Reflexes: Jaw jerk
 1. Ask patient to hang the jaw freely (while eyes are closed).
 2. Place your left index finger on the chin of the Patient
 3. Tap your finger by a hammer
 4. Look for jaw closure

5- Facial nerve(CN 7) (In young or uncooperative patients you may only be able to comment on the facial weakness or asymmetry) Organize your approach into two procedures:

- Motor
 1. Inspect the face for symmetry
 2. Ask Patient to do the following, note any lag, weakness, or asymmetry:
 - Close both eyes tightly against resistance
 - Smile
 - Show teeth
 - Blow his cheeks

• Sensory

6- Acoustic nerve (CN 8) Organize your approach into three procedures:

- Hearing testing: Voice test
 - 1 Stand beside the patient at a distance of about 50 cm
 2. Whisper at very low voice
 3. Ask the patient to repeat what is said
 4. Compare both sides

7- Glossopharyngeal and vagus nerves= 9, 10

- Comment on voice
- Comment Deglutition
- Palatal reflex
 1. Advance the torch with the tongue depressor in the patient mouth so that you press the tongue and see the pharynx clearly

2. Notice the position of the uvula if it is central or deviated to one side
- Gag reflex
 1. With the other tongue depressor in your left hand touch the posterior pharyngeal wall
 2. Comment if the patient gags or not

8- Accessory nerve= 11

- **Examine trapezius and sternomastoid**
 1. Stand behind the patient while he is sitting on a chair
 2. look for atrophy or asymmetry of the trapezius muscles
 3. Place your hands over both shoulders
 4. Ask the patient to elevate shoulders against resistance, and palpate the trapezius in both sides
 5. Place your hands so that the right hand is pushing the right side of the patient mandible, and the left hand is palpating the patient's right sterno- mastoid muscle
 6. Ask the patient to push against you right hand and test the muscle for power
 7. Replace hands, to test for the other sternomastoid muscle

9- Hypoglossal nerve =12

Ask the patient to protrude the tongue and observe deviation

MICRONUTRIENT DISTURBANCES

Micronutrient = nutritional element needed in minute amount, e.g. vitamins & trace elements.

Requirements:

Minimum requirement of a nutrient is set by expert committees from total parenteral nutrition studies. Daily requirement range is set between ± 2 SD around a whole population mean need. In childhood, estimates of requirement are usually based on limited data & they change over the years.

Physiologic Considerations:

Fat-soluble vitamins

VITAMIN	FUNCTION	SOURCES	DAILY REQUIREMENTS
A (Retinol)	Epithelial cell integrity. Vision.	Liver, milk, eggs, green & yellow vegetables, fruits.	400-420 μ g 400-700 μ g 0.8 - 1 mg
D	Serum Ca & P maintenance.	Fortified milk, cheese, liver.	10 μ g
E	Prevents lipid peroxidation.	Seeds, vegetables, germ oils.	Not known $\approx$ 3-10 mg (FA intake)
K	Clotting factors II, VII, IX, X & proteins C, S synthesis.	Liver, green vegetables, intestinal flora synthesis.	10-100 μ g, if no flora synthesis.

Water-soluble vitamins:

VITAMIN	FUNCTION	SOURCES	DAILY REQUIREMENTS
B1 (Thiamine)	Coenzyme for ketoacid decarboxylation	Liver, meat, milk, cereals, legumes, nuts.	Infant 0.3-0.5 mg Child 0.7-1.2 mg Adolescent 1.1-1.4 mg
B2 (Riboflavin)	Coenzyme for flavoprotein in red-ox reactions.	Milk, cheese, liver, meat, eggs, grains, green vegetables	Infant 0.4-0.6 mg Child 0.8-1.4 mg Adolescent 1.3-1.7 mg
B6 (Pyridoxine)	Coenzyme for amino & fatty acids metabolism	Meat, liver, grains, nuts, soybeans, milk cereals.	Infant 0.3-0.6 mg Child 0.9-1.6 mg Adolescent 1.8-2 mg
B12	Cofactor for heme & DNA synthesis	Meat, fish, cheese, eggs, milk	Infant 0.5-1.5 μ g Child 2 - 3 μ g Adolescent 3 μ g

VITAMIN	FUNCTION	SOURCES	DAILY REQUIREMENTS
Niacin	Coenzyme I & II (NAD) in red-ox reactions.	Meat, fish, liver, grains, cereals, green vegetables.	Infant 6 - 8 mg Child 9 - 16 mg Adolescent 14 - 18 mg
Folate	Coenzyme for amino & nucleic acids metabolism.	Liver, cereals, green vegetables, cheese, milk (except goat).	Infant 30 - 45 µg Child 100-300 µg Adolescent 400 µg
Biotin	Cofactor for amino & fatty acids carboxylation.	Yeast, cereals, meat, eggs, intestinal flora synthesis.	35 -200 µg if no flora synthesis.
V C (Ascorbate)	Essential for collagen, carnitine & noradrenaline synthesis.	Citrus fruits, berries green vegetables, tomatoes.	Infant 35 mg Child 45 mg Adolescent 50 - 60 mg

-Trace elements:

ELEMENT	FUNCTION	SOURCES	DAILY REQUIREMENTS
Mg (Magnesium)	Bone & teeth. Muscle & nerve. CHO metabolism.	Cereals, legumes, nuts, meat, milk.	Infant 50-70 mg Child 150-250 mg Adolescent 300-400 mg
Fe (Iron)	Structure of Hb, myoglobin & cytochrome C & catalase enzymes.	Liver, egg yolk, green vegetables, grains, legumes, nuts.	Infant 10 - 15 mg Child 15 - 10 mg Adolescent 18 mg
Zn (Zinc)	RBC carbonic anhydrase, intestinal carboxypeptidase, hepatic dehydrogenase & protein & RNA synthesis.	Meat, grains, nuts, cheese.	Infant 3 - 5 mg Child 10 mg Adolescent 15 mg
Cu (Copper)	Needed for RBC & Hb formation, iron absorption & several oxidases.	Liver, fish, oysters, meat, grains, nuts, legumes.	1 -1.5 mg
Fl (Fluorine)	Bone & teeth.	Water, sea, animal & plant foods, tea.	≈ 0.6 mg

ELEMENT	FUNCTION	SOURCES	DAILY REQUIREMENTS
Cr (Chromium)	Aids insulin action.	Yeast, meat, grains.	≈ 4-100 µg
I (Iodine)	T3 & T4.	Sea food, iodized salt.	Infant 40 - 50 µg Child 70 -120 µg Adolescent 150 µg
Se (Selenium)	Cofactor for glutathione peroxidase.	Vegetables, meat.	Infant 10 - 30 µg Child & adolescent 40 - 70 µg

Cobalt (Co) is a component of vitamin B12 (cobalamin) molecule & of erythropoietin. Its daily requirement is linked to that of B12. Manganese (Mn) is in bone & cartilage structure & in animals it is associated with many enzymes, but in humans its metabolic role & daily requirements are uncertain. Several other trace elements essential for animals have been described, but their roles & daily requirements in humans need to be established. They include molybdenum, nickel, tin, vanadium, lead & silicon, but that list is likely going to be extended.

Micronutrient deficiencies:

-Fat-soluble vitamins deficiencies:

They are usually stored in the liver in large amounts & deficiency manifestations occur after these stores are depleted.

VITAMIN	MANIFESTATIONS	TREATMENT	
A (Retinol)	Night blindness, xerophthalmia, Bitôt spots, keratomalacia, follicular hyperkeratosis, ±PEM, serum < 20 µg/dl.	5-10 x10 ³ iu/d p.o or 180 x10 ³ iu/6 mo p.o (3 iu=1µg)	
D	Nutritional rickets	1-6 x10 ³ iu/d p.o for 4-6wk or 6 x10 ⁵ iu i.m. (40 iu=1µg).	
E	Hemolysis, skin changes in preterms Loss of neural integrity.	Neonate 15-25 iu/d. After 100-1000 iu/d	p.o. i m.
K	Umbilical bleeding in newborns. Skin & orifice bleeding.	Neonate 1 mg/d. After 5-10 mg/d	p.o. i m.

-Water-soluble vitamins deficiencies:

They are not stored, so deficiency manifestations occur rapidly.

VITAMIN	MANIFESTATIONS	TREATMENT
B1 (Thiamine)	Infantile beriberi: irritability, anorexia, polyneuropathy, heart failure (+PEM =wet), death.	5 - 25 mg/d. ± other B complex & PEM.
B2 (Riboflavin)	Anorexia, mucositis, cheilosis, seborrhea, anemia.	5 - 25 mg/d. ± other B complex.
B6 (Pyridoxine)	Convulsions, microcytic anemia, seborrhea, neuropathy, ± malabsorption, drugs.	25 - 50 mg/d. ± other B complex.
B12	Anemia (macrocytic), polyneuropathy, posterior & lateral column disease, vitiligo.	1-5 µg/d, better i.m.
Niacin	Pellagra: photosensitivity (necklace, gloves, socks), dermatitis, diarrhea, dementia, death, ± other nutritional deficiencies, drugs (INH).	25 - 50 mg/d. ± other B complex & nutritional deficiencies.
Folate	Anemia (macrocytic), ± malabsorption, drugs (methotrexate).	1 mg/d.
Biotin	Alopecia, dermatitis, hypotonia, death.	0.15- 0.3 mg/d
C (Ascorbate)	Scurvy: irritability, poor wound heal purpura, gum & periosteal bleeding.	250-500 mg/d.

-Trace elements deficiencies:

They are present in the soil & their concentration varies from place to another, so their deficiency tends to be geographically distributed (humans & animals feed on plants which get minerals from soil).

ELEMENT	MANIFESTATIONS	TREATMENT
Mg (Magnesium)	Tetany, $\pm$ PEM, hypocalcaemia.	Mg-rich diet, or $\approx 300-400$ mg/d.
Fe (Iron)	Anemia (microcytic, hypochromic), decreased growth & mentality, pica.	3 mg/kg/d.
Zn (Zinc)	Decreased growth, appetite & taste, anemia (Fe), alopecia, skin lesions, hepatosplenomegaly, pica.	0.2 - 1 mg/kg/d.
Cu (Copper)	Anemia (hypochromic), osteo-porosis, neutropenia, hypotonia, hypoproteinemia, vitiligo, ataxia.	Cu-rich diet, or 60 μ g/kg/d.
Fl (Fluorine)	Tendency to dental caries.	Fl-rich diet, or fluoridated table salt.
Cr (Chromium)	Glucose intolerance, poor weight gain, neuropathy, $\pm$ PEM.	Cr-rich diet or $\approx 1 - 3$ mg.
I (Iodine)	Goiter, cretinism (congenital MR, deafness, spasticity), juvenile myxedema (MR, dwarfism).	I-rich diet, or iodized table salt.
Se (Selenium)	Cardiomyopathy (2 types in China & Siberia).	1 mg/d.

Micronutrient toxicity:

-Fat-soluble vitamins toxicity:

As they are stored in the liver in large amounts, toxicity occurs after these stores are saturated. This may occur accidentally or extra supplementation (iatrogenic) to healthy child, but rarely when treating a deficiency.

ITAMIN	TOXIC DOSE	MANIFESTATIONS
A (Retinol)	Chronic $20-50 \times 10^3$ iu/d ($\times 10$ daily requirements), for weeks or acute mega-doses ($\times 100$ daily requirements). (3 iu = 1 μ g)	Dry yellow skin, alopecia, sore tongue, anorexia, hyperostoses, aches, increased ICT (bulging fontanel, $\pm$ headache, vomiting, papilledema, fits), weakness, hepatosplenomegaly
D	Chronic $3-4 \times 10^3$ iu/d for weeks or acute 4×10^5 iu/d. (40 iu = 1 μ g)	Anorexia, nausea, weakness, hypercalcemia, headache, tissue calcifications, nephro-calcinosis, polyuria, renal failure, hypertension.
E	300 - 600 iu/d.	Weakness, diarrhea, bleeding.
K	10 mg/dl (water soluble)	Neonatal jaundice (more in preterms)

Water-soluble vitamins toxicity:

As they are not stored, acute large doses are needed to produce toxicity. Accidental poisoning is the cause as adult medications of mega doses are present in the market.

VITAMIN	TOXIC DOSE	MANIFESTATIONS
Niacin	200 -1000 mg/d.	Histamine release (ulcers, asthma, flushing, itching), gout, hepato-toxic.
B6 (Pyridoxine)	2 - 6 g/d.	Sensory neuropathy. Fetal-neonatal dependency & convulsions.
C (Ascorbate)	$\approx < 1$ g/d. (individual & age dependent)	Uricosuria, oxaluria ($\pm$ stones). Hemolysis in G6PD deficiency. Rebound scurvy in infants. False-positive test for glucosuria & false-negative test for hematochezia.

Trace elements toxicity:

Toxicity of iron from poisoning or repeated blood transfusions will lead to secondary hemosiderosis. Toxicity of zinc from galvanized iron cooking utensils can cause GIT upsets & copper deficiency. Excessive dietary copper is suspected to cause Indian childhood cirrhosis. Excessive dietary fluorine ($>4-8$ mg/d) causes teeth mottling & $\pm$ osteosclerosis (fluorosis). Other trace element toxicity is rarely seen, mainly during total parenteral nutrition & treated with its suitable chelating agent.

رقم الإيداع بدار الكتب المصرية

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